LIBRARY OF CONGRESS
205.574...
MAY 21 1890

THE AMERICAN GAS LIGHT JOURNAL

REDMANKENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LII.—No. 20. Whole No. 780. | NEW YORK, MONDAY, MAY 19, 1890. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, N.Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. No book will be sent C. O. D.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
Western Gas Association 693

EDITORIALS—
Briefly Told 694
The Day is at Hand—The Gas Statistics Branch of the Eleventh Census—Notes.
The Market for Gas Securities 694
Did Dr. Wilkinson Confine Himself to Facts? by Mr. Jas. Somerville 695
An Odd Experience in a Purifying Room, by Mr. Irvin Butterworth 695
Notes upon Distributory Plant, by Mr. W. J. Warner 695
Gas Engines with Electrical Ignition 697
*Dye's Apparatus for Washing Gas 698
Progress of the Electric Light in Australia 699
The Identity of Light and Electric Radiation 700
Spontaneous Combustion of Coal in Ships 700
ITEMS OF INTEREST FROM VARIOUS LOCALITIES 702
Improvements at Rome, N. Y.—Annual Meeting, South Side Company, Pittsburgh, Pa.—Glass Mains for Vapors and Liquids—Opposition at Burlington, Ia.—All Right at Ironton, O.—Annual Meeting, Perth Amboy, N. J.—Personal—Annual Meeting, Metropolitan Company, Elizabeth, N. J.—Capital Stock Increased—Annual Meeting, Altoona, Pa.—Cheaper Gas for Syracuse, N.Y.—Strike at Peoples Works, Manchester, N. H.—Death of Chas. Monson—Annual Meeting, Bangor, Me.—An Accident—Tinkering the Meter Inspection Laws, Canada—Improvements at North Adams, Mass.—More about the Strike at Manchester, N. H.—Manager McMillan's Plan at La Crosse, Wis.—Gas Company for Summit, N. J.—And Many Other Items.
Ingenious Expedient in Hydraulic Engineering 705
Useful Memoranda and Information for Engineers 705
CORRESPONDENCE—
Gas Companies Should Control the Introduction of Gas Stoves... 705

[OFFICIAL NOTICE.]

Western Gas Association.

SECRETARY'S OFFICE, WESTERN GAS ASSOCIATION,
QUINCY, ILLS., May 14, 1890.

The Thirteenth Annual Meeting of the Western Gas Association will be held at the Lindell Hotel, St. Louis, Mo., on the 21st, 22d and 23d days of May. The hall in which the business sessions of the Association will be conducted is within the hotel building, is very commodious, quiet, and in every way excellently well adapted to our requirements. The hotel management has granted on this occasion the following rates: For single room and board, $2.75 per day; for room with bath, $3.25 per day. These rates will apply to members in attendance, their families and visiting brethren. In this connection I am instructed by the Local Committee of Arrangements to give our members warning of the fact that in order to secure suitable accommodations, their rooms *must be engaged in advance.* Your Secretary has been in the habit of making an announcement to this effect with exceeding regularity from year to year, and just as regularly no one, or at least only very few, pays the slightest attention to the warning. The necessity of engaging quarters in advance, however, is in this instance very urgent. Now that the old Planters' House has been closed, the Southern and Lindell Hotels often have more business thrust upon them than they are capable of handling, and of late it has been no unusual occurrence for them to deny would-be guests admission, unless their rooms had been previously spoken for. But all of our members can be accommodated without the slightest jar or friction, if they will but take the trouble to address a line to the "Proprietor of the Lindell Hotel, St. Louis, Mo.," telling him the kind and price of room or rooms desired. This should be done at least one week in advance of the first day of the meeting.

In addition to the reduction in transportation rates granted by the Central Traffic Association, the Trunk Line Association has also joined in the movement. As the boundary of the latter Association extends as far east as the western border of the New England States, our Eastern friends will be enabled to avail themselves of the reduced fares.

I am authorized to state that Mr. R. D. Walsh, Chairman of the Local Committee of Arrangements, has kindly consented to take charge of all articles destined for the Gas Exhibit, and will cheerfully surrender a generous portion of his time to the interests of exhibitors. Communications, consignments of gas stoves, apparatus, burners—anything, in fact, intended for the Exhibit—may be directed to Mr. Walsh, in care of the Laclede Gas Light and Coke Company. Exhibitors can rest assured that not only will their wares receive careful handling and be displayed to the best possible advantage, but that they themselves will be accorded the most courteous treatment at the hands of Mr. Walsh and his efficient committee.

The "Paper List" for our Thirteenth Annual will be as follows:

"Relative Value of Gaseous Fuels," by B. E. Chollar.

"Effects of Natural Gas Competition," by James Somerville.

"An Argument in Favor of the Adoption of a Uniform System of Estimating the Cost of Gas in the Holder," by George G. Ramsdell.

"Impressions of British Gas Works," by George T. Thompson.

"Mixed Gases," by E. G. Cowdery.

"Wrought Iron, Cast Iron, or Steel—which is the Best Material for Street Mains?" by Eugene Printz.

"What Policy Should the Gas Interest Adopt in Connection with the Approaching World's Fair?" by Walton Clark.

"On the Abuse of the Patent System as Bearing on the Gas Industry, with a Remedy," by Frederic Egner.

"The By-Products of Experience," by Allen R. Foote.

The attention of the Board of Directors is called to the fact that Section I., of Article VII., of our By-Laws reads as follows: "The Board of Directors shall meet as such at least once in each year, on the day preceding the annual meeting of the Association, at which time they shall determine in regard to the propriety of the various papers, drawings, models, or other matters constituting the special order, being laid before the Association." The Board of Directors elected at our last meeting is composed of the following-named gentlemen, who are, therefore, particularly requested to assemble at the Association's headquarters on Tuesday morning, May 20, at 10 o'clock:

J. B. Howard, E. H. Jenkins, Z. T. F. Runner, John Gimper, C. W. Butterworth, E. G. Cowdery, J. S. Ambrose, J. W. Dunbar, and B. E. Chollar.

The social features of the Thirteenth Annual, as provided by the Entertainment Committee, will be as follows:

On Thursday evening there will be a grand moonlight excursion and supper on the Mississippi, the handsome steamer *Oliver Bierne* having been engaged for the occasion. A trip will be made up the river as far as the Chain of Rocks, giving a view of the new water works now in process of construction, and also of the recently completed Merchants' Bridge. On returning, the steamer will run down below Carondelet, affording a beautiful twilight view of the full 16 miles of the city's front along the Mississippi. Supper will be served, and there will also be music and dancing, the boat returning to the wharf at 10 o'clock.

On Friday, at 10:30 A.M., carriages will be in readiness at the hotel for delegates and their guests. A drive will be taken through the western portion of the city as far as the Fair Grounds, where a luncheon will be served at the Jockey Club House. After a series of entertainments, beginning at 2 o'clock P.M., which have been generously tendered by the Board of Directors of the Fair Grounds, parties wishing to take a drive through the parks may do so at their pleasure, in carriages provided by the committee.

Ladies accompanying delegates can obtain carriages at any time during Wednesday and Thursday for such purposes as they may desire.

From the above it will be seen that the time-honored custom of serving a banquet on the second night of our reunion will be departed from. This is an innovation which the committee feels assured will receive a hearty welcome from the "Toast-Responders;" and possibly from many others for the mere sake of a change, if for no other reason.

Application blanks, copies of our By-Laws, and any information not contained in these communications will be cheerfully furnished by

A. W. LITTLETON, Sec'y.

(Since writing the foregoing, your Secretary has received word that the lines operated by the Southern Passenger Association will grant the same rates as those which will be given by the Central Traffic and Trunk Line Associations, viz., one fare and one-third for the round trip. These fares can be obtained on the certificate plan. Any railroad ticket agent within the territories of these three passenger associations will take pleasure in informing a member as to the steps that are required for securing these reduced fares. It is hoped that every delegate who can do so will avail himself of the reduction.)

BRIEFLY TOLD.

THE DAY IS AT HAND.—Before this number of the JOURNAL shall have been completely distributed the Thirteenth Annual of the Western will be over and its record a part of history. Look at it as we may, at the time of writing, however, we are in the full knowledge that the session is to be a memorable one. Every arrangement for the mental and social side of the occasion has been made, and made with thoroughness and cleverness. The Eastern delegation will be on hand in greater numbers than ever before, and they go in the certainty that a royally fraternal time is to be their portion.

THE GAS STATISTICS BRANCH OF THE ELEVENTH CENSUS.—The following, from Superintendent of the Census explains itself. We hope that the proprietors of gas works will see to it that the returns respecting the gas industry are as full and complete as it will be possible to have them. The compilation cannot fail to benefit all, and that benefit will be in exact proportion to the completeness of the figures submitted. Supt. Porter's letter is as follows:

"DEPARTMENT OF THE INTERIOR, CENSUS OFFICE,
WASHINGTON, D. C., May 14, 1890.

Census of Manufactures.—On the 2d day of June the work of collecting statistics of manufactures for the report of the Eleventh Census will be inaugurated throughout the entire country. The value of this report must depend wholly upon the accuracy and thoroughness with which manufacturers answer the questions propounded. The personal interests of every manufacturer are involved in the character of the report on Manufactures. It will be quoted for the next ten years as the official announcement of the *exact* industrial condition of the country, and will be the basis for any future legislation that may be enacted in regard to the wants of our people, whether engaged in agricultural or mechanical pursuits. Therefore it is of vital importance to each manufacturer that an accurate report shall be made. The Superintendent of census has taken every possible precaution in the preliminary work to make this census complete and satisfactory, and the earnest co operation of those engaged in productive industry is all that is now necessary to secure valuable results. Every manufacturer should bear in mind that his answers to the questions relating to his business are held strictly confidential, are not disclosed to any competitor or to other persons, and are not used by the Government as predicate for the purposes of taxation or license, or in any way adversely to affect his individual business. This assurance is printed on each schedule over the signature of the Superintendent of Census. The expert Special Agent in charge of this branch of census work, Mr. Frank R. Williams, has personally visited the principal manufacturing centers and consulted representative manufacturers, the publishers of trade journals, and practical business men generally, for the purpose of ascertaining the proper scope of the inquiry for each branch of manufacture. The questions contained in the census schedules are those suggested by the manufacturers and other persons most interested in the progress of the country, and cover ground absolutely essential to the proper presentation of its industrial conditions and resources.—ROBT. P. PORTER, Supt. of Census."

NOTES.—In a letter to the publishers, dated Alton, Ills., May 12, Secretary Tracy, of the Alton Gas and Electric Light Company, writes: "Alton at this time is experiencing quite a boom. We are building a $30,000 opera house, an I. O. O. F. temple, and a public library. In fact you can hardly visit any part of the city without witnessing some evidence of growth in the shape of new residence buildings, etc. With all this bright outlook the Gas Company shares its part. I will lay about one-half mile of 3-inch main as soon as I can get the pipe. I will also put in a hot tar scrubber and substitute iron sponge for lime. A comparison of April 1889 and 1890 shows an increase in gas sales to private consumers of 29 per cent., and from appearances at this time, next April will show an increase of at least 50 per cent. over the April just closed." The light of the present seems to hold its own.——At the annual meeting of the Easton (Pa.) Gas Company the following Directors were elected to serve for 3 years: Samuel Boileau, Robt. I. Jone and Wm. A. Seitz. At the Directors' meeting the following officers were elected: President, S. Boileau; Treasurer, Edward Hilliard; Secretary, W. G. Stewart; Supt., W. H. Ward.——The furnaces of the Pennsylvania Tube Works, Pittsburgh, will be remodeled to burn producer instead of natural gas. The cost involved in fitting the works for the change will not be less than $120,000.——A gas company for Norwich, N. Y., has been incorporated by Messrs. Dudlev Farlin, J. White Sprong and E. F. Murray. It is capitalized in $50,000.——Mr. Lucius D. Rhodes, Superintendent of the Holyoke (Mass.) Water Power Company's gas works, died at his home in that city on the 7th inst. He came to Holyoke in 1863, from the works of the Hartford (Conn.) Gas Company, and his record in the former place speaks for itself. He was in his 61st year.

The Market for Gas Securities.

The upward movement in Consoldated gas continued through the week, and the stock is bid for to-day (Friday) at 105¼. We would advise caution now in the matter of its purchase; that is, in respect to purchase on speculative account. For investment purposes it is worth at least 110. Mutual gas is very strong, the bid figure being 115 with no shares offering. Brooklyn stocks are steady. The event of the week, perhaps, was the rise in Chicago Trusts, which sold up to 67¼. To-day the stock is bid for at 63¼. We would not advise purchase at anything above 60, for the present at least. Bay State is up to 84, and will soon be in the dividend list. Laclede common is up to 27½, and the preferred, at 64 to 70, looks to be a purchase.

Did Dr. Wilkinson Confine Himself to Facts?

By Mr. James Somerville.

Dr. Wilkinson, in his lecture on "Some Facts Connected with the Manufacture of Water Gas," as published in your issue of April 28th, makes a statement regarding coal gas which appears to me, coming from such a source, ought not to remain any longer uncontradicted. In speaking of the purity of water gas, he says, "Compare this with coal gas, where we have from 20 to 40 grains of sulphur, and from 5 to 7 grains of ammonia to the 100 feet."

If he had said seven-tenths of a grain of ammonia, and from 8 to 10 grains of sulphur per 100 feet, he would have been much nearer the truth. Ammonia is too valuable a product to allow any of it to be retained in the gas. There is no sulphureted hydrogen, and the amounts of sulphur compounds that may escape the action of the lime and oxide are so small that the resultant sulphurous and sulphuric acid from the combustion of the gas is practically harmless to health.

The bleaching of the goods to which he refers is not due to the impurity of the gas, but to the stratum of highly heated air to which they are constantly exposed. The same result has been observed in houses in which gas was never used. As for those poor people whom he so pathetically describes as dying of slow poison, this distressing condition is not due to impure gas, but to the want of oxygen or fresh air, and it seems to me it would have been more in keeping with his profession if, instead of decrying the use of gas, he had insisted upon a proper system of ventilation.

Our friends, the enemy, are not slow to pick up such statements and use them to the disadvantage of our industry.

An Odd Experience in a Purifying Room.

By Irvin Butterworth.

Last fall this Company (the Columbus, O., Gas Light and Coke Company) purchased a lot of new oxide, two car loads of the Connelly sponge and three of Prof. Douglas's ferric oxide, from Michigan. The material was put into use in the usual way, the two oxides soon becoming thoroughly mixed together until the material was homogeneous. We endeavored to revive the spent material by blowing air through it in the "off" boxes, by means of a rotary blower operated by a gas engine. The cover was not removed, and the air was blown into the inlet, passing up through the oxide in the same manner as the gas passes, and escaping through the small cap-hole in the cover.

This plan of revivification worked successfully for some time, and we did not have any trouble whatever from the heating of the oxide, though we had to empty and refill boxes occasionally, on account of back pressure caused by the caking of the material.

But the oxide soon began to apparently lose its efficiency, and after being revived in the above manner would soon pass the sulphureted hydrogen, necessitating two or three changes daily, and the almost constant running of the blower. Our material, we noticed, had begun to assume a dark, greenish appearance, and that which we would remove from the boxes and expose to the air would not go through the chemical heat of revivification, nor change its color from the dark green to the characteristic brown of properly revived oxide. In fact, it did not seem to reoxidize a particle. And yet, by frequently changing boxes and keeping our blower in operation almost night and day, we have been able to purify our gas.

I should mention, as having a possible bearing upon our ability to do this, that during about 16 or 18 hours out of every 24 we scrub our gas through hydraulic main liquor, of about 2 ounces strength; and we also constantly introduce into our gas at the exhauster about 1 per cent. of air.

About three weeks ago, as an experiment, we discontinued the running of the blower, and tried the effect of throwing the material out of the boxes and exposing it to the air in the old way, with the effect of increasing, slightly, the length of time that the boxes would run without changing, but not tending, to any perceptible degree, to bring the dark green material back to the proper color, nor promoting its revivification to any very noticeable extent.

An analysis of our purifying material (which has been lightened by the admixture of about one-third its bulk of sawdust) shows that it now contains over 10 per cent. of sulphates of iron. This, of course, accounts for its dark green color. Just how much iron it contains in other forms, and what the total percentage of sulphur is, we do not as yet know; but an analysis is about to be made to determine these points. In the meantime, we are able to purify our gas by making two or three changes daily.

Three or four questions present themselves, viz.:

1st—As our material does not show any of the evidences of revivification on being removed from the boxes when foul, how, or by what agent, is our gas being purified?

2d—If it is sesquioxide of iron in our material that is performing this work, why does the material not show some of the usual evidences of revivification?

3d—Have any gas companies who revive their oxide by blowing air through it had any experience similar to ours?

4th—Has the blowing of air through our oxide been the cause of our trouble, and if so, how could this plan have a different effect in this respect from that of exposing the material to the air?

Notes upon Distributory Plant.

[Read by Mr. W. J. Warner, of South Shields, before the North of England Gas Managers' Association. Reprinted from the London *Journal*.]

I very much regret not having been in a position to comply with the request of your Committee to contribute on the present occasion a paper to this Association. Though not in possession of matter of sufficient importance for a paper, I had a few notes which I thought might interest you, and draw forth some expression of opinion, which, backed by observation and experience, might be of value at a time when an attempt is being made by the users of steam rollers to remove from themselves the responsibility attached to such use.

In a paper on the subsidence of gas mains, by Mr. Drewry, of Cleethorpes, read at the recent meeting of the Eastern Counties Association, the writer gives his experience with mains laid in loose soil subjected to tidal influences and disturbed by sewerage works—resulting in a considerable subsidence of the main and its ultimate fracture. Reference was made in the discussion of the paper to the general disturbance of gas mains by "the necessities of domestic civilization," so termed by Mr. C. E. Jones, of Chesterfield—viz., the "water-carriage system, sewers, the multiplicity of telegraph, telephone, and electric lighting poles, and electric lighting mains." It will be observed that reference here is only made to the disturbance of the ground from these operations—the actual doing of the work. Beyond these disturbances within, if they may be so termed—the cutting of the trenches, inadequate shoring, improper filling in, and the disturbance of the joints by such operations—there is the disturbance from without, or from the surface of the ground—the road making operations, the general traffic over the ground, and the passing of heavy loads over the surface of the road.

Having a record, extending over some years, of the defects found in mains and pipes other than those of an ordinary character, I have arranged them in a tabulated form. Though this scarcely covers the whole of the ground, yet it may be of some value as a contribution to the subject. These entries of the whole are divided into five divisions, with the number of breakages in each, and the percentages, the sizes of the smallest and largest pipes, and the mean diameters, as follows:

No.	Cause.	No. of Breakages.	Percentage of Whole.	Sizes of Pipes. Max. Inch.	Min. Inch.	Mean. Inch.
1.	Bad castings	7	6.48	12	1¼	3.79
2.	Drainage operations	51	47.22	6	¾	2.29
3.	Heavy weights passing over roads ...	16	14.82	12	2	3.62
4.	Steam roller passing over roads	17	15.74	6	¾	2.40
5.	Unknown	17	15.74	8	1	3.00

Two of the latest reports are as follows: "March 11, 1890.—Jarrow district: Escape in a ¾-inch service; connecting piece drawn from main by pressure of steam roller; the pipe end quite *bright;* pipe bedded in soft clay." "April 2, 1890.—Shields district: Escape up lamp pillar; opened out the service, and found it extended from the end of the main; a connecting piece drawn from the socket; the end of pipe was as *bright as silver;* steam roller was there a few days prior to escape being reported; pipe laid in clay." I am told there have been other cases in these districts; but until that reported on March 11, when the pipe was taken out of the ground "quite bright," attention was not directed to the matter as the cases were only considered as ordinary disturbances of service pipes. But these cases of brightly burnished pipes attracted attention and were reported to me shortly after the other case was found. One of the pipes I have here on the table; the other, unfortunately, has been mislaid.

The general experience of an excessively heavy weight passing over mains and pipes is drawn joints and fractured pipes, caused through the pipes being laid in a yielding soil, or in one of varying densities, or over an unequal rocky surface. It is not, I believe, an uncommon opinion that the disturbance of the mains and pipes is confined to the direct downward pressure of the weight—that is to say, that a heavy casting, or traction engine, or a heavy steam roller passing over mains and pipes will affect only those immediately under the weight. But may there not be other disturbances from the same cause not so obvious, being further removed, but still directly traceable to this downward pressure? There must of necessity be a lateral disturbance of the subsoil. In a case under my own observation there were yards of guttering, curb, and concrete pavement forced up along a line parallel with the track of a steam roller about two yards away from the nearest edge of the roller; thus proving, if proof were necessary, in the clearest manner, that there are other disturbing movements than those of the direct downward pressure of the moving weight. The injury then may be more remote, and the cause of a more complex character than is generally assigned to such disturbing influences.

The ultimate effect may be a general and permanent settlement of the plant till a further disturbance of the ground takes place; but there may be (and it is to this that we should direct attention) such an elasticity in the ground and plant, or in the plant alone, that a prejudicial action may be maintained by the ordinary traffic over the road, and so affect the joints of the pipes. In other words, the compression of the ground in which the pipes are laid may not only cause an immediate disturbance of the joints and breakage of the pipes, but may throw such strains upon the plant that there may be a deteriorating action continued, accompanied by a constantly increasing quantity of gas unaccounted for—an increase which might baffle every attempt to discover the cause of the loss, but which may be accounted for by a general deterioration of plant from the vibratory action of a steam roller. If the pipe shown may be taken as a true indication of the otherwise unseen action upon the mains and pipes, the fractured pipes and the drawn joints of mains, though more dangerous, are of little consequence when compared with this action, as they will soon tell their own tale and get repaired. But the other necessitates a constant, careful watchfulness and expense, which, I may say in passing, is not dreamed of by the promoters of electric lighting. Whether such deterioration is going on, and whether it will be continuous, must be a matter of observation. Doubtless, with the repeated rolling of the ground it will become more consolidated, and therefore better able to resist undue action and excessive pressure when so consolidated. A general inspection, repairing, and testing of the plant may again reduce the unaccounted-for gas to a moderate percentage of the make.

Though, in the percentages given, the steam roller injuries are lower than the drainage operations, yet the roller may have helped to swell the latter. However, this fact stands plainly out—that nearly 70 per cent. of the injuries to the distributory plant of a gas undertaking arise from the operations of local authorities; and if there be a still further general deterioration it behoves such authorities to carry on their work with much greater watchfulness than has been sometimes done—to shore, and fill in their drainage trenches with more care; and to use the roller over the ground in the forming of new roads before the pipes are laid, thus avoiding any greater settlement than there must of necessity be. I would also suggest that, in the carriage of excessive heavy weights over the roads—such as a casting drawn by a team of 25 horses—there should be a previous notice given to the local authorities, and the route to be taken decided on and registered. Such a course is justified by the fact that about 16 per cent. of the injuries recorded were caused by this work; and we may fairly assume that a portion of the percentage of "unknown" was from the same cause.

Now what is the remedy—that to which I directed attention some years since, viz., districting and sub-districting a town, as far as it can practically be done, and isolating and testing the mains. Since my paper was read I believe much has been done in this direction. Papers have been read upon the subject abroad; and the latest patent is that of the combination syphon test-box for this purpose, by Mr. Lyon, of Cosham. In the meantime closer attention should be given to the syphons than I believe is generally done. They should be sounded at regular intervals, and the depth of water found entered in a book and compared. Thus the syphons may become indicators of the condition of the mains; and through them the leakage traced to its source. This will not, however, be equally serviceable in all soils. Then there is that beautiful, sensitive and serviceable machine—the governor, which may be made to do excellent service in this work if closely observed, as it will give a very good indication of an increased flow of gas into a district; and for such work I believe that form which is manipulated by counterbalance weights is the best.

Discussion.

Mr. W. Ford (Stockton) said he was afraid that what little information he could contribute was almost all contained in the paper which Mr. Warner had so carefully prepared. Mr. Warner made no remark as to whether, since steam rollers had come into vogue, he had adopted the ordinary method of laying service pipes and mains deeper. Some years ago they had very great trouble with the steam roller in Stockton; and it necessitated considerable relaying of their pipes. Since then they had had very little trouble. Mr. Warner said that something more than downward pressure was to be attributed to the steam roller. It was natural that the surface might be a movable subject; but still the under ground might be quite firm, and the service pipe or main would receive no damage from the steam roller. If ordinary care was exercised in the laying of mains a great amount of trouble and anxiety to gas companies and corporations would be avoided. He was, however, only stating his own experience of the last 14 or 15 years. In consequence of the precautions they had taken in the deepening of their mains and service pipes the leakage, which, before the era of the steam roller (some 16 to 21 years ago), was 24 per cent., had been reduced to an average of 5 per cent. for the last few years. So that he thought, with care, where steam rollers were in existence, gas managers might reduce the leakage, independently of the action of the local authorities.

Mr. Pettigrew, Gas Engineer to the North-Eastern Railway Company, said he found that his services were often pulled out but seldom drawn. The weight actually dragged them out, and broke the mains at the place where they were connected. He had found pipes, 6, 8, 12, 14 and 20 inches in diameter, drawn sufficiently for his hand to be passed between the two; but this was caused by subsidence of the soil. He had constantly to be cutting out and putting pieces into the mains, but not into the services. Their services were laid in pitch boxes, not deep; and they always discovered, where a weight went across a pipe, it was downward action that took place—the pipe was broken, but never drawn.

The President said he was sure they were very much obliged to Mr. Warner for his paper. Four or five years ago he had some experience of the action of the steam roller. Some time previously a new sewer had been laid in the street, below the gas and water mains; and evidently a subsidence took place below these, or rather on one side of them. When the roller was put to work there, it broke first the water and then the gas pipe. The water pipe was 3 inches in diameter, and the gas pipe 2 inches. The water carried the gas down into the sewer below. It was a street something like 500 yards in length, and the gas entered the cottages on one side of the street through the drains. They did not observe the escape in the street; and when they became aware of its existenee they could not find it. They had to cut the street at both ends and isolate it, and follow the main until they found the leakage. This was caused by the subsidence of the subsoil, and the steam roller running over the top. The result might have been disastrous; but happily they discovered it before very serious consequences took place. He did not understand Mr. Warner to say that the service was drawn asunder, but that there was a motion, an actual draw, by the passage of the roller over them—a sort of lateral motion. He himself had seen the curb of a street puff up by the passage of a steam roller 3 or 4 feet from it; and in that case there must have been a lateral motion of the soil underneath the surface. He had a 2-foot main laid some little time ago, and the trench was filled up during wet weather. No portion of it was less than 4 feet deep; and yet the pressure of the steam roller lifted the pavement 5 feet away. This must have been a lateral motion. Gas pipes should be laid very carefully. He thought Mr. Warner's paper would be worth perusal, and they would no doubt profit by it.

Mr. Pettigrew said that at the last meeting of the Association he put before the members a pipe modelled to prevent drawing, and he thought it would be a very good thing to design a pipe which, when it moved in a lateral direction would tighten itself.

Mr. Warner showed a service pipe which had been drawn from the socket and burnished by the action it had undergone. He thought the burnishing must have been done by moving backwards and forwards. He exhibited it, he said, just as it was removed from the ground; and it was proof positive that there must have been vibration upon it. This was not the only case. He had one similar to it; and on looking through some pipes on the previous day he saw there were others. It was not simply a breakage; but a breakage first and then a vibration upon it. Alluding to Mr. Ford's remarks, he said it would be almost a matter of impossibility to take up 60, 80 or 100 miles of mains and relay them. But, of course, as mains were relaid, or new ones were being laid, precautions could be taken to place them at a greater depth. As, however,

their President had remarked, this would not meet their case entirely. Though he went down 4 feet, yet there were deeper trenches—sometimes three times that depth—for sewage pipes. It would not avail them to go further down, unless care were taken in filling in the trenches. The nature of the ground had something to do with it, undoubtedly. A surveyor of a Tyne district told him a short time since that he knew of a case where a steam roller sank to below the axle. If this were to happen how could their pipes escape damage? He congratulated Mr. Ford upon his being able to bring his unaccounted-for gas so low. He did not know that it was a general experience; but he himself nearly approached 5 per cent. a few years ago. He, however, found the leakage had been growing year after year since the steam roller began to be used. With reference to this percentage, though it was scarcely the matter under consideration, he might remark that it depended entirely upon how they dealt with it—upon what, for instance, they considered the amount consumed in public lighting. Until they obtained fixed figures for this, he thought they were not able to deal with the percentage except upon broad grounds.

Mr. Ford observed that his decrease had been accomplished under similar conditions to those under which he had 24 per cent. of leakage.

Mr. Warner remarked that there was still the question of whether the quantity had increased or decreased as well as the percentage. He was not altogether clear with regard to Mr. Pettigrew's observations. He thought he showed first that he did not know of any drawing of the joints of pipes.

Mr. Pettigrew said that his remark was that it was the weight—the vertical pressure—which caused a pipe to loosen, not the drawing pressure; that the pressure bent the pipe downwards and generally broke it.

Mr. Warner did not see that, as a rule, the pipes should be broken. It was the joint which gave way. The President's remarks were, of course, above criticism; but he might say that they bore out entirely his own experience in these matters. He thanked the members for their reception of his paper.

Mr. Hall (West Pelton) said he wished to add that he found an efficient method of preventing the drawing of service pipes to be to place (after the connection was made, and the trench filled in to the level of the pipe) several stones alongside the connection, and then when a subsidence took place the pressure came upon the stones, and not upon the pipe. If the place were opened years afterwards there would be a cavity but no fracture. He had found this in numbers of cases. The subsidence did not take place in the solid ground, but where the connection was made.

Gas Engines With Electrical Ignition.

In the report made to the Franklin Institute, by its special delegate to the Paris Exhibition (Mr. Carl Hering) on the electrical exhibits at that exhibition, we find the following respecting gas engines on display that are started by means of electrical ignition:

The ignition of the gases in gas and petroleum engines by an electric spark appears to be coming into use more generally, judging from the large proportion of engines exhibited in which this way is preferred to the gas flame ignition. There were exhibited twenty-one different systems of gas and petroleum engines, counting the various different exhibitors of the Otto engine as one exhibit. Of these, thirteen (or sixty-two per cent.) used electrical ignition, and only eight (or thirty-eight per cent.) used the gas flame ignition.

Historical.—The following abstract regarding the history of electrical ignition is taken from a paper of Mr. Delamere-Debouttevill, read before the Institution of Mechanical Engineers, July 3, 1889. In 1844, John Reynolds used a platinum wire heated by means of a battery. A mechanical contact maker and breaker started and stopped the current at the proper moment. In 1850, Shepherd used an electro-magnetic generator in place of a battery. In 1857, Barsanti and Mattenni used a Bunsen battery, with a de la Rive multiplier, the sparks from which were used. In 1860, Lenoir replaced the de la Rive multiplier by a Rhumkorff induction coil. The primary current passed continually, and the secondary was closed when the spark was required. There was difficulty in timing the spark exactly.

General.—The heated platinum wire is apt to become cooled at the moment of the passage of the gases, and it cannot be timed sharply, besides requiring considerable battery power. It therefore seems to be abandoned. All the engines exhibited used the spark. The chief advantages of the spark over the gas flame, appear to be, its very high temperature, which is of importance, especially when poor gases are used; it is independent of cold or moist air; it reduces the temperature of the valve chest and parts, and thereby facilitates lubrication of those parts and does away with incrustations there; in some of the systems it can be very definitely timed, which is claimed to be very important as there is said to be a considerable difference in the power if the time of ignition varies one-twentieth of a second. The disadvantages of using electricity in place of the gas flame depend upon the particular system used; in general it introduces something with which the ordinary mechanic is not familiar.

The systems exhibited are here divided for convenience into four classes. All in common use this ignition only, having no means for gas ignition, showing that they can rely entirely on the spark. In all but one, the spark is made to pass in the cylinder, in the other it is in a special chamber. The insulation of the parts entering the cylinder are variously of porcelain, plaster of paris, or asbestos, in order to stand the heat and the mechanical pressure of the explosions.

First System.—In the first system, a battery, generally two or three large Bunsen or bichromate cells, is used with an ordinary Rhumkorff induction coil having a simple hammer vibrator; the vibrator acts all the time while the engine is running, and the spark of the secondary coil is operated by various means. In all of these the spark passes between two *fixed* points in the cylinder. The advantages of this system over some of the others are that there are no moving parts entering the cylinder; that there are numerous sparks generated instead of a single one, as in some of the others; and that the spark can be well timed. The disadvantage is that the vibrator acts all the time, which is bad for the contacts of the vibrator, and consumes battery power continually.

Details.—In the Engine exhibited by E. Rogers (French Section) the secondary circuit is normally open at a sort of switch outside of the cylinder, which is operated by the moving parts of the engine, and is closed the instant the spark is required for the explosion. When the switch is closed the only break in the secondary circuit is in the cylinder, where the sparks are therefore produced. It is evident that no premature explosions can take place.

In the engines of Louis Charon and those of Solomon Freres and Tenting (French Section) the secondary circuit is continually short circuited outside of the cylinder, except the instant when the spark is required. Premature explosions cannot take place unless this short circuiting switch is exceedingly dirty. They used two large cells.

Those of Thomas Powell (French Section) differ essentially from the others, in that the spark passes continually in a spark chamber, which is closed by the slide valve. When ignition is to take place, a port in the slide valve makes this spark chamber communicate with the cylinder, thus igniting the gases. The length of the spark is 1.5 mm., or about one-sixteenth inch. They claim that the instant of ignition can be more accurately and definitely timed by these ports in the slide valve. There is probably more possibility of premature explosions, as in the flame ignition engines, causing it to "sneeze." They use only one cell of two carbon plates in bichromate solution, the zinc being in sulphuric acid in a porous cup.

Second System.—In the second system a battery and induction coil are used as before, but the primary circuit, instead of the secondary, is closed when the spark is required. The vibrator, therefore, acts only while the primary circuit is closed, thus economizing battery power. It has the same advantages as the first system, except that the spark is not so definitely timed, and is not so sure, as it is necessary that the vibrator starts itself and responds promptly; to do this it must be well adjusted, and its contact must be very clean; it is difficult, if at all possible, to clean it while running.

To this class belong the engines of the Societe des Moteurs a Gaz Francais, A. F. Noel (French Section), and of the Societe Anonyme des Moteurs Inexplosibles au Petrole et au Gaz (Belgian Section). In these the primary circuit is operated by a contact piece on the shaft or other moving part, and a brush sliding thereon, usually made adjustable in order to time the spark. The one exhibited by Rouart Freres and Cie (French Section), was a double-clyinder engine, and in addition to the above there was a second contact piece on the revolving shaft connected to the secondary circuit, and having two brushes, the object of which was to switch this secondary circuit alternately to each of the two cylinders. They used only two large one gallon bichromate cells. The frame of the engine was used as a ground return circuit for both the primary and the secondary currents.

Third System.—In the third system a magneto machine is used to generate the spark without an induction coil. The armature of the magneto, usually a simple Siemens H armature, is kept from revolving by a strong spiral spring. For each explosion it is revolved on its shaft through 90° against this spring and allowed to snap back into its normal position, during which rapid return motion it generates a momentary current. An instant after the armature is released, and at the moment

when its current is a maximum, the circuit is broken in the cylinder, producing there a single bright spark. The advantages are that no battery is required, there is no coil with a vibrator to keep in order, and it is always ready to start; as the high rate of rotation necessary to generate the current is produced by a snap movement, no great speed of the engine is required at starting, as would be the case if a dynamo was used in place of a magneto. A disadvantage is that only one spark is produced in place of a number of them as in the other systems, but as it is a much more powerful spark, and quite positive, it does not appear to be an objection. In this system there must be moving parts entering the cylinder to break the circuit there.

The engines of Gotendorf and Cie, and of E. Delahaye (French Section) were of this class. In the latter, the exact time of the spark may be adjusted by a cam movement. The engine of W. C. Horne (British Section) also belongs to this class, it differs from the other two in that the H armature is normally in the stable position into which the magnets would pull it, the spring assisting it to return to the position, while in the other two the normal position is the unstable position, in which it is held against the magnetic pull by the spring, which must, therefore, necessarily be much stronger. The spark is produced between two steel springs in the cylinder, operated by means of a rod passing through a stuffing box. This rod has a rotary motion instead of a longitudinal one, thereby facilitating the construction of the fire-proof stuffing box.

Fourth System.—In the fourth system a dynamo or magneto is turning all the time, generating the current which is broken in the cylinder directly without a Rhumkorff coil. The disadvantages of this system are that in starting the engine, sufficient speed must be produced by hand before the dynamo will generate sufficient current to produce a spark.

In the engine of E. Durand (French Section), a small simple magneto is used generating an alternating current. Both wires are insulated, that is, the frame of the engine is not in circuit. The circuit is broken in the cylinder by a revolving rod, as in the engine of Horne. No self induction coil is used.

In the Baldwin Gas Engine (United States Section) the current is generated by a small shunt-wound dynamo of about one-eighth horse power. It is driven directly from the fly-wheel by a friction pulley, the pressure being produced by its own weight. There are two friction pulleys of different sizes, the smaller one, for high speed, is used only for starting. There is a self induction or spark coil in circuit, and the circuit is closed except when the spark is required. The breaking of the circuit is operated by an insulated pin passing into the cylinder and having a longitudinal motion. It is difficult in this arrangement to keep the contacts in the cylinder clean, especially as the tendency of this particular construction is to destroy its own contact.

Dye's Apparatus for Washing Gas.

On January 28th U. S. Letters Patent (No. 420,378) were granted to Nathaniel C. Dye, of Rutland, Vt., for an improved method and device for washing gas. In his specification the inventor says :

My invention consists of an improved method and a novel apparatus for washing, scrubbing and cooling gas, as will be hereinafter described and specifically claimed.

In the accompanying drawings, Fig. 1 is a vertical central section of

Fig 1.

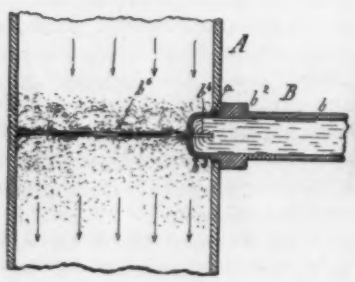
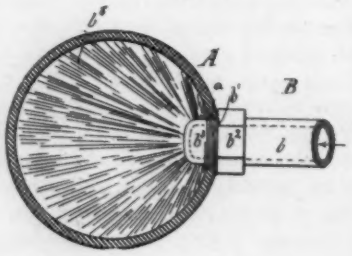


Fig 2.

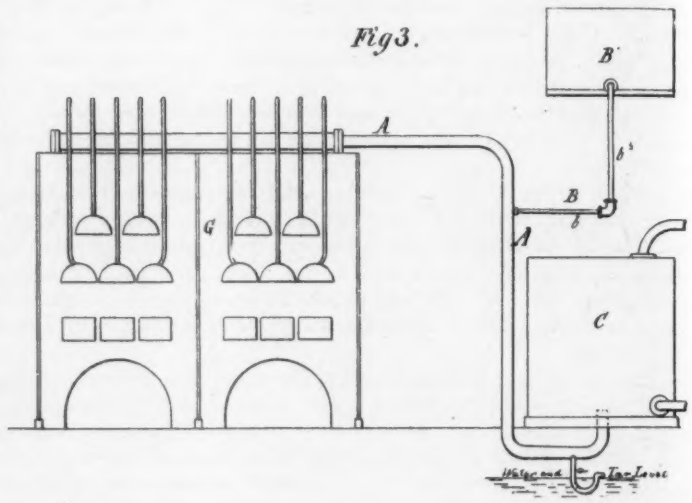


a main gas pipe provided with the improved gas washer, scrubber and cooler ; Fig. 2 is a horizontal section of the same ; and Figs. 3 and 4 are diagrams of two types of gas generators and purifiers having a main pipe provided with the improved gas washing, scrubbing and cooling apparatus.

The letter *A* in the drawings represents a main pipe of a gas generator ; *B*, a gas washer and cooler : *G*, a gas generator, and *C*, a gas purifier.

Between the gas generator *G* and purifier *C* of a gas works the main pipe *A* is placed, and it conducts the gas from the former to the latter. Into this pipe *A* the nozzle portion *b* of the gas washer and cooler *B* is secured by means of a screw-thread b' on the said nozzle portion and a corresponding screw-thread *a* in the pipe *A*. A prismatic formation b^2 on said nozzle portion serves to facilitate the use of a wrench for fastening or unfastening the nozzle portion. The nozzle b^3 extends into and slightly beyond the inner surface of the pipe *A*, and is there provided with a longitudinal slot b^4, forming a narrow flat orifice, which

Fig 3.

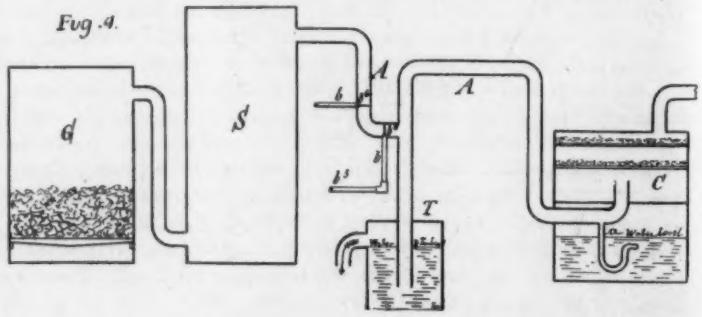


terminates at the inner surface of the pipe *A*. This nozzle portion *b* is connected by means of pipe or conduit b^5 with an elevated reservoir *B'*, from which the water is conducted under pressure through said pipe or conduit b^5 into the nozzle portion *b* and through the slot b^4 into the pipe *A*, and thus a transverse diaphragm or unbroken sheet b^6 of water is produced, which strikes the whole inner surface of pipe *A*, and, rebounding, is dashed into spray in the manner described. Through this diaphragm or water-sheet b^6 and the spray thereof the gas from the generator is forced, and being thus thoroughly mixed with the same is freed by the current and the spray of such impurities as readily unite with water, and it is at the same time cooled down to such a degree that the remaining tar and nearly all the other impurities are precipitated or concentrated, and thereby separated from the gas.

In connection with the invention it is proposed to use lime as a purifier, the slaked lime being placed in trays or sieves within purifier boxes, and the gas, after having been washed, scrubbed and cooled, as herein described, is passed through the lime on its way from the generator to the gasometer.

The pressure necessary for producing a powerful current of water may be secured from a highly elevated reservoir, a force pump, or other suitable means, and this pressure may be varied to suit circumstances. A pressure of about 65 pounds to the square inch has been found to work very satisfactorily. While the pressure at the head or source of the water is 65 pounds to the square inch, there is very little pressure comparatively in the thin sheet of water which stands across the main gas pipe,

Fig 4.



and through which the gas passes from the generator to the purifier, for when the water leaves the end of the nozzle it is in a body of only about one-eighth of an inch thick, as seen in the drawings, and runs off as rapidly as the pressure in the nozzle will cause it to flow, and it is immediately carried away with the condensation of the gas vapor through the siphon at the bottom of the pipe, and thus the gas pipe is always free

from water—accumulated water, which would be liable to retard the flow of gas and cause a back pressure. The resistance of the thin sheet of water is not more than sufficient to keep the sheet in a diaphragm form and in slight contact with the inner surface of the pipe, and thus insure the subjection of the entire volume of gas to the washing, scrubbing and cooling action of the cool water.

If desirable, several nozzles *b* may be employed at suitable distances apart, so that the water will flow through several transverse water sheets b^6 in succession, and thus be subjected to a more effective treatment of cleansing and cooling.

In practice it is often found necessary to run in water gas works about 6,000 feet of gas in 20 to 25 minutes through an 8-inch pipe, and the gas leaves the superheater while it is red-hot, or ofttimes at a white heat. The gas in this condition strikes the diaphragm of water, about 5 feet from the superheater, and hence I generally employ two or more, but sometimes only one, diaphragms of water. This depends upon how fast gas is generated in a given sized generator and under a given amount of heat. When the gas strikes the first diaphragm of water, the water strikes every particle of gas vapor, or nearly every particle. Should there be any vapor that has not come in contact with the first diaphragm and spray from it, the second one would take up what escaped from the first, and so on, according to the number of spaced water diaphragms within and along the pipe between the generator and purifier. The solid sheet or sheets of water completely fill the circular space across the pipe to the extent of the thickness of the sheet or sheets, leaving no space for the gas to pass except it passes through the diaphragm or diaphragms of solid water. This operation is different from that ofs praying or jetting water upon gas in the pipe, because the gas in the sprinkling method has freedom, in part, to pass between the jets of water, and thus it is not all subjected to the action of the water in its passage to the purifier.

In the water mains of Rutland, where I have introduced my invention, 65 pounds pressure to the square inch being used, I have found one nozzle sufficient; but where the pressure of the water in the water mains is but 25 pounds to the square inch, two or more nozzles might be necessary. All depends, as above stated, upon the amount of gas generated. It is a very convenient arrangement to apply, as I have shown, one or two nozzles immediately between the gas generator and purifier, as the gas can be washed, scrubbed and cooled, and then at once passed directly into the purifier.

It is obvious that if the gas mains be made of squared or any other appropriate form than cylindrical, the same result of forming a complete diaphragm of water across the pipe would be produced if the slit in the end of the nozzle is extended entirely across the nozzle from the inner surface of the pipe on both sides of the nozzle.

Before entering the purifier the gas is relieved of water and tar by means of an escape or drip pipe *a*, provided in the pipe *A*, which for that purpose enters the purifier from below. This drip cup may be in the form of an inverted siphon, forming a gas trap, which allows only tar and water to escape in the manner illustrated. In Fig. 4 I have shown a construction which I have successfully employed. It consists of a generator *G*, superheater *S*, sealing tank *T*, and lime purifier *C*, supplied with water nozzles *b*, between the superheater and sealing tank. It will be readily seen that the sealing tank serves the same purpose as the above-described inverted siphon drip pipe *a*. Before entering the purifier the gas is again relieved of any water and tar precipitated during its passage beyond the bottom of the purifier by means of an inverted siphon drip pipe *a*, as above described. In this apparatus I may also employ one or more nozzles *b* in the pipe *A* between the generator and superheater, and provide in the lowest portion of the pipe a drip pipe *a* as described.

Progress of the Electric Light in Australia.

Mr. E. J. Erskine, writing on this subject in the London *Electrician*, says the first introduction of the electric light into New South Wales was in 1881, when Mr. H. H. Kingsbury, who two years previously had introduced the telephone into this Colony, carried out an installation of arc lamps at the Redfern railway station for the government. At the present time there are upward of 5,000 incandescent and 500 arcs in the colony. In 1883 the Legislative Assembly was lighted by the same firm with incandescent lamps; Edison machines were used with great success, but lately it has been deemed necessary to increase the light, and new machines of the Manchester type have been installed. But it was really in 1887 that the advantages of the electric light were properly recognized. In this year Her Majesty's Theater Company decided to adopt this system of illumination for their new building, and a plant for 900 lamps was installed, Manchester machines being used. In 1888 Messrs. Harrison and Whiffen appeared in the field as agents for Crompton & Co., and secured the contract for lighting the town of Tamworth, where they installed a plant on the continuous current system, which has given satisfaction in the town. In 1888, also, an impetus was given to the electric lighting business through the opening of a number of skating rinks in which the proprietors desired to have the electric light; but as these installations were nearly all of a temporary nature, the work was not of a character to be encouraged, switches, cut-outs, ampere or voltmeters being conspicuous by their absence. It would be more satisfactory to all parties concerned if the fire underwriters' rules were more stringently enforced; as, although we have so far been very fortunate in Australia, having had no accidents that could be attributed to the electric light, it is more by good luck than by good management; and now that the number of installations is increasing, it is most necessary that every precaution possible to prevent accidents should be taken.

Last year was a busy year in electrical circles in all the Colonies; in Melbourne, on account of the extensions of central stations, and in New South Wales, on account of the number of country boroughs which called for tenders; but perhaps the most important event of the year was the introduction into New South Wales of the first alternating current transformer plant installed by Messrs. Kingsbury & Co. in Young. This plant is on the Thomson-Houston system, and the success has been such that the firm has received the contracts for Penrith and Lambton. It should, however, be mentioned that although this is the first introduction of the alternating current in New South Wales, both the Thomson-Houston and Ganz & Co. have been working the system in Melbourne for some time with great success.

So far as motive power is concerned there appears to be a general leaning towards engines of the semi-portable type, and it is an exception when a plant is erected with separate boilers and engines. The standard of work done by firms in Sydney has been gradually improving during the last few years, and now it has reached a creditable pitch; the installations at the office of the *Daily Telegraph*, and that in the new hotel in Bent street—being the latest addition in Sydney—are in every respect highly satisfactory; also the temporary lighting of the Centennial Hall with arc lamps reflects great credit on the contractors. Perhaps the first thing that would strike an electrician coming here and going round the different installations would be the deplorable lack of ventilation and space in the engine and dynamo room, with one or two exceptions—a state of things highly detrimental to efficient working of the plant. Architects might be forgiven for not knowing that ventilation is a great advantage in a dynamo room from a commercial standpoint; but they should not lose sight of the fact that the attendant requires air to make it possible for him to look after his machinery. In one case the attendant is nearly suffocated by the fumes from some accumulators. It seems to be the general impression that any hole is good enough for electrical machinery.

Up to the present there is no central station lighting in Sydney; whereas in Melbourne there is a considerable amount of lighting done from the stations in operation, and there are other stations in contemplation. The reason for this difference in progress between the two largest cities in the Southern hemisphere may perhaps be accounted for by the fact that in Sydney the Gas Company has a monopoly of the lighting; and although two bills have at different times been introduced to enable companies to erect central stations and supply light and power, they have never got beyond the first stages, and have then been allowed to lapse. In Brisbane there has lately been a considerable movement toward the electric light; and central stations will, I think, shortly be an accomplished fact in the Northern Colony. If so, Sydney will have been left behind by all her neighbors, as at present there are no rumors of a central station here. However, the New South Wales country municipalities are, to a certain extent, making up for the indifference shown by the metropolis, as at the present time there are two of the interior towns lighted; in three others the work is in progress, and seven others are either considering or calling for tenders. Under these circumstances it must be admitted that the outlook is very promising.

So far as traction is concerned, very little has been done in any of the colonies. Some time ago a trial was made of a car on the Julien principle, but, although the trial was successful, nothing more was heard of it. At the present moment an electric tramway is talked of for Balmain, a suburb of Sydney, and I believe it is to be on the Sprague system. Victoria once more takes the lead in the matter of electrical tramways, having one at Box Hill which is giving satisfaction, although I hear the rails through which the return is made are not all that could be desired, the joints being very primitive, and therefore the resistance very great.

There is one matter that is doing a considerable amount of damage to the electrical industry. I refer to the exaggerated reports that appear from time to time in the daily papers, copied from home papers, of the dangers of electric lighting in general, and of overhead wires in particular. Many persons in the country districts reading these articles immediately imagine that the introduction of the electric light is nothing more or less than the introduction of a new kind of plague.

The subject perhaps most under consideration here at present in the country municipalities is whether arc or incandescent lighting should be adopted for street lighting. The great argument relied on by the advocates of arc lighting is, that whereas it requires 500-horse power to obtain 100,000-candle power with incandescent lamps, the same number of candle power would be obtained with 50-horse power with arc lamps. Of course this is absurd; but they will not understand that the two systems cannot be compared by their nominal candle power. So far the five municipalities who have decided on the electric light have adopted the incandescent with good results, and it certainly hardly seems necessary in towns of 6,000 inhabitants to go to an enormous expense of lighting the town with arc lamps, the night traffic being quite insignificant.

In Victoria the railway authorities are turning their attention to lighting their trains by electricity, and once more the younger Colony will be ahead of New South Wales, as the system now in vogue here is an elaborate system of gas illumination, the installing of which involved a large outlay; and it is, therefore, not probable that the authorities will, for some time, at any rate, consider the question of electric lighting, which would necessarily entail another large expenditure.

The prospects of electric lighting in the other Colonies, viz., New Zealand and Tasmania, should be very good, the abundance of water power which is at the disposal of engineers giving every opportunity for the electric light to compete with any other system of illumination.

The Identity of Light and Electric Radiation.

According to the *Gas World*, during the past couple of years a very remarkable series of investigations has been carried on by Prof. Hertz, of Berlin, on the above subject. The phenomena of induction—an object at a distance becoming electrified across the intervening space through the influence of a charged body—are very well known, and are, indeed, quite familiar; and Clerk Maxwell showed, 25 years ago, that this action is not, as gravitation appears to be, instantaneously propagated throughout space, but travels with a definite velocity; and he went on to measure this velocity by methods with which we need not concern ourselves here, but which brought out the startling result that the velocity of propagation of electric induction is the same, at least within one per cent. or so, as the velocity of light. On the other hand, it is known that heat, light, and the ulta-violet radiation present us with a series of ether waves, the length of which ranges from $\frac{3}{1000}$ to $\frac{3}{10000000}$ inch. But there ought to be circumstances under which less frequent waves than these—waves of greater length—would be formed; and if they were formed they would obey the same wave-motion laws as are followed in the phenomena of light, radiant light, and actinic radiation. Up to Hertz's researches, however, these longer ether-waves had not been observed, though Clerk Maxwell's result afforded a very emphatic hint in what direction to look for them. Hertz has found them; and by so doing he has added another to the links which bind the various parts of physical science into one general science of matter and energy. Lecturing lately in Berlin, Hertz gave an account of some of his experi ments; and we propose to give our readers a short sketch of the interesting results at which he has arrived.

After overcoming some considerable preliminary difficulties in realizing the results which he foresaw, Hertz succeeded in arranging two conductors so that a continuous spark jumped across the 0.12-inch space between them, and in producing, in a similar gap between two wires, a spark due to induction. This secondary spark was sometimes increased by putting a reflecting wall of metal or other conducting material behind the primary spark; but it was sometimes diminished and brought to naught; and the maximum spark was produced when the reflecting wall was at about 6.6 or 19.8 inches behind, the minimum when it was at about 13.2 inches; whence it followed that the phenomena of wave interference were in play, and the wave length was about 26.4 inches. By the use of a zinc mirror, of parabolic form and large size, with the primary spark at its focus, the reflection was rendered more manifest; and by means of such a mirror and an opposite reflecting metallic plate, as many as four model points can be obtained in the axis of the mirror. At each of these there is no effect on the secondary wires when there placed, and midway between them the spark-inducing action is at its maximum. The wave length being 26.4 inches, the number of complete waves must be (taking the velocity to be the same as that of light) $\frac{1}{12}$ thousand millions per second—very much less frequent than the slowest heat wave yet observed (20 million millions per second). In wires the wave length appears to be only 23.2 inches; somewhat less than in air. These phenomena only occurred in the axis of the mirror, just as with light, and Hertz felt justified in speaking of electric radiation.

But then, having got so far, he proceeded to see whether this electric radiation was subject to the ordinary well known optical laws.

He first tried to produce shadows, and found that with a metallic screen of zinc, tinfoil, or even gilt paper, the radiation could be obstructed; but that it traversed insulators, such as a wooden door, which are therefore transparent to it. There were phenomena pointing towards diffraction; there was no sharp shadow; indeed, there could not have been, any more than sound waves of the same length (about B in the treble clef) could produce a sharp shadow on a small screen.

The next step is a decidedly astonishing one—namely, the discovery of the polarisation of the electric radiation. The conductors producing the primary spark were arranged parallel to one another and vertical; then the throbs in the conductors were vertical; the throbs in the primary spark were vertical; and hence the radiation waves were up and down ones. Keeping that in view, the mirror may be so shaped that two such mirrors will, in the crossed positions, act like a polariser and an analyser in polarised light; and a piece of tourmaline, to be placed between these "crossed prisms" so as to restore some light, may be imitated by means of a wooden framework over which are stretched parallel wires. Just as in the optical phenomena light is seen to pass through or to be shut off, so here the waves were either allowed to pass and produce the secondary spark, or else were cut off while the secondary spark disappeared. Hertz concludes from some other phenomena that, not only is there an electric disturbance in the vertical plane in the case supposed, and at right angles to the ray, but that there is also at right angles to the electric undulation, and also to the ray, a magnetic periodic disturbance; which is exactly a somewhat unintelligible phenomena predicted by Clerk Maxwell in ordinary light.

After polarisation, reflexion is easy to understand. We have already seen phenomena of reflection in this series of experiments; Hertz has established the fact that the law of equality of the angles of incidence and reflexion is obeyed by conducting mirrors.

Refraction, too, may be rendered manifest by the use of a huge prism of hard pitch, which is transparent to the waves, but refracts them as if they were light waves passed through a prism whose refractive index is 1.69; the optical refractive index of bodies of this class is between 1.5 and 1.6; but this divergence is not great, when regard is had to the experimental difficulties and the crudity of the material employed.

There is about all this a simplicity and directness which give it high rank as an experimental research.

Spontaneous Combustion in Coal Ships.

[Read by Prof. Vivian Lewes at a meeting of the English Institution of Naval Architects.]

The author first referred to the Royal Commission of 1875, and stated that in the nine years following the report 57 coal laden vessels were known to have been lost from the spontaneous ignition of their cargoes, while 328 were missing from unknown causes. It is said that the increase of steam pressure and consequent increase of temperature has made spontaneous ignition of coal cargoes more likely to occur. The paper next dwelt with the composition of coal, pointing out that its volatile constituents or hydrocarbons consist essentially of compounds containing carbon and hydrogen, together with a little oxygen and nitrogen. The ash which is left after the coal is burnt consists chiefly of sulphate of lime or gypsum, silica, and alumina, whilst in nearly all coal is to be found iron disulphide, known as coal brasses or pyrites. This has been formed by the gradual reduction of the sulphates by carbonaceous matter in the presence of iron salts. Of these constituents of coal the only ones which play no part in spontaneous heating are the mineral constituents other than the pyrites.

Carbon possesses to an extraordinary degree the power of attracting and condensing gases upon its surface, this power varying with the state of division and density of the particular form of carbon used. The absorptive power of newly-won coal varies, but the least absorbent will take up 1¼ times its own volume of oxygen, whilst in some coals more than three times their volume of the gas is absorbed. This apsorption is very rapid at first, but gradually decreases, and is influenced very much by temperature. The absorption is at first purely mechanical, and itself causes a rise of temperature, and the rate varies with the amount of sur-

face exposed, so that when coal or charcoal is finely powdered, absorption becomes more rapid, and rise of temperature at once takes place. If charcoal is kept for a day after it has been made, out of contact with air, and is then ground down into a powder, it will frequently fire after exposure to air for thirty-eight hours; while a heap of charcoal powder, of 100 bushels or more, will always ignite. In the case of coal, this rise in temperature all tends to increase the rate of the action which is going on; but is rarely sufficient to bring about spontaneous ignition, only about one-third the amount of oxygen being absorbed by coal that is taken up by charcoal, while the fact of the action being much slower, tends to prevent the temperature reaching the high ignition point of the coal. Air-dry coal absorbs oxygen more quickly than wet coal.

The action of the bituminous constituents is next considered in the paper. All coal contains a certain percentage of hydrogen, which is in combination with some of the carbon, and also with the nitrogen and oxygen, and forms with them the volatile matter in the coal, and the amount present in this condition varies very largely, being very small in anthracite and very great in cannel and shale. When the carbon of the coal absorbs oxygen, the compressed gas becomes very chemically active, and very soon commences to combine with the carbon and hydrogen of the bituminous portions, converting them into carbon dioxide and water vapor. This chemical activity increases rapidly with rise of temperature, so that the heat generated by the absorption of the oxygen causes it to rapidly enter into chemical combination, which is accompanied by evolution of heat, and this further rise of temperature again increases rapidity of oxidation, so that a steady rise of temperature is set up. This taking place in the centre of a heap of small coal, which, from the air and other gases inclosed in its interstices, is an admirable non-conductor of heat, will often cause such heating of the mass that if air can percolate slowly into the heap in sufficient quantity to supply the necessary percentage of oxygen for the continuance of the action, the igniting point of the coal will be soon reached.

The action of pyrites is next considered by the author. It is found in coal in several different forms, sometimes as a dark powder distributed throughout the mass, or in larger quantities forming thin golden-looking layers. Sometimes it occurs as large masses and veins, often 1 in. to 2 in. in thickness, but these masses rarely find their way into the screened coal for shipment. If the air is dry the pyrites undergo but little change at ordinary temperatures; but in moist air they rapidly oxidize when in a finely divided condition, the first action being the formation of ferrous sulphate and sulphur dioxide, together with the liberation of sulphur, the relative amounts of the two latter being regulated by the temperature and the supply of air, whilst longer contact with moist air converts the ferrous sulphate into a basic ferric sulphate generally termed "misy." It is during this process of oxidation that the heat supposed to cause the ignition is evolved. But when it is considered that some of the coals most prone to spontaneous combustion contain only eight-tenths of a per cent. of iron pyrites, and rarely more than 1¼ per cent. the absurdity of imagining this to be the only cause of ignition becomes manifest. If 100 pounds of coal were taken, and the whole of the pyrites in it concentrated in one spot and rapidly oxidized to sulphate, the temperature would barely be raised to 100° C., if all loss of heat could be avoided.

The author had carefully determined the igniting point of various kinds of coal, and found that—

Cannel coal.....	ignites at	698°	F. = 370° C.
Hartlepool coal ..	"	766°	F. = 408° C.
Lignite	"	842°	F. = 450° C.
Welsh steam coal.	"	870.5°	F. = 477° C.

So that no stretch of imagination could endow the small trace of pyrites scattered through a large mass of coal, and undergoing slow oxidation, with the power of reaching the needful temperature.

Dr. Richters fully realizes this point, and discards the idea of the pyrites doing anything more than adding their mite to the causes which bring about rise of temperature. In this, however, Professor Lewes thinks he is mistaken, his (Prof. Lewes') experiments pointing to the fact that the pyrites may increase the liability to ignition when present in large quantities, and do so by liberating sulphur under certain conditions. Sulphur has an igniting point of 482° F., or 250° C., so that the presence of free sulphur would lower the ignition point of the coal by considerably over 100°C. Also the pyrites as they become oxidized to ferrous sulphate swell in size, and so tend to split up the coal into small pieces, and by extending a large extent of fresh surface to the air cause energetic chemical action.

On examining the evidence to be obtained as to the conditions under which spontaneous ignition of coal in ships usually takes place, it is found that liability to ignition increases with:

1. The increase in tonnage of cargoes.

Thus, in cargoes of under 500 tons the cases reported amount to a little under ¼ per cent. for shipments out of Europe; from 500 to 1,000 tons, to over 1 per cent.; from 1,000 to 1,500 tons, to 3.5 per cent.; 1,500 to 2,000 tons, to 4.5 per cent.; and over 2,000 tons, to no less than 9 per cent.

a. The larger the cargo the more non-conducting material will there be between the spot at which heating is taking place and the cooling influence of the outer air.

b. The larger the cargo the greater will be the breaking down action of the impact of coal coming down the shoot upon the portions first loaded into the ship, and the larger, therefore, the fresh surface exposed to the action of the air.

2. The ports to which shipments are made; 26,631 shipments to European ports in 1873 only resulting in 10 casualties, whilst 4,485 shipments to Asia, Africa, and America gave no less than 60.

This result is partly due to the length of time the cargo is in the vessel, but a far more active cause is the increase in the action brought about by the increase of temperature in the tropics.

3. The kind of coal of which the cargo consists. The author is of opinion that East Coast coal is more dangerous than South Wales coal; but so much depends on the amount of small coal present that a well-loaded cargo of any coal would be safer than a cargo of Welsh steam coal in which a quantity of dust had been produced during loading. The idea that the percentage of pyrites present is any indication of the liability to spontaneous combustion must be entirely discarded, as experiment shows that many coals poor in pyrites frequently ignite, whilst others rich in them are perfectly safe.

A much surer guide is to be found in the quantity of moisture present in an air-dried sample of coal, which is a sure index to the absorptive power; the higher the amount of moisture held by the coal after exposure for some time to dry air, the greater will be its power of absorption for oxygen, and the greater, therefore, its liability to spontaneous heating and ignition.

4. The size of the coal; small coal being much more liable to spontaneous ignition than large, on account of the increased surface exposed.

5. Shipping coals rich in pyrites whilst wet; which increases the rapidity of disintegration.

6. Ventilation of the cargo. The so called ventilation which has from time to time been introduced into coal ships is undoubtedly, the author says, one of the most prolific causes of spontaneous ignition. For ventilation to do any good, cool air would have to sweep continuously and freely through every part of the cargo (a condition impossible to attain), whilst anything short of that only increases the danger, the ordinary methods of ventilation supplying just about the right amount of air to create the maximum amount of heating. The reason of this is clear. A steam coal absorbs about twice its volume of oxygen, and takes about 10 days to do it under favorable conditions; and it is this oxygen which in the next phase of the action enters into chemical combination and causes the serious heating.

7. Rise in temperature in steam colliers due to the introduction of triple-expansion engines and high-pressure boilers. It has been fully pointed out that anything which tends to increase the initial temperature increases the rapidity of chemical action. The average increase of temperature in the stokehold in two of the Indian troopers from the use of the triple expansion engines was found to be about 5°.

Having discussed the chemical and physical conditions which lead to "spontaneous ignition," the author proceeds to formulate precautions.

The coal should be large, and it is better if free from pyrites. When air-dried it should not contain more than 3 per cent. of moisture.

No coal should be shipped to distant ports until at least a month has elapsed since it was brought to the surface at the pit's mouth. Every precaution should be taken to prevent breaking up the coal whilst being taken on board, and on no account must any accumulation of fine coal be allowed under the hatchways. When possible the coal should be shipped dry.

The coal compartments should be made gas-tight, as far as the bulkheads separating them from the rest of the ship is concerned. When the coal has all been taken in, it should be battened down, and the hatches should not be again opened until the vessel reaches her destination, the only ventilation allowable being a 2-inch pipe just inserted into the crown of each coal compartment, and led 12 feet up the nearest mast, the top being left open. This would be quite sufficient to allow free egress to any gases evolved by the coals, but would not allow undue access of air. The author next proceeded to describe an automatic alarm apparatus he had devised for indicating when the temperature in a cargo of coal had risen to a dangerous extent. It consists of a long bulb of

glass, containing mercury, and has an insulated wire inserted into the quicksilver, and making contact with it, whilst the stem attached to the bulb has a second wire in it, so arranged that when a rise of temperature causes expansion of the mercury, in rising in the tube it makes contact, and the wires from these tubes are in connection with an electric bell, index board, and battery in the captain's room. The author also describes an arrangement of flasks containing liquid carbonic acid gas which he proposed to distribute in the coal cargo. These flasks would be closed by an alloy, which would fuse at 200° F. In this way the gas would be liberated upon the coal becoming heated to a dangerous extent, and the intense cold produced by the expansion of the liquid into gas would cool down the coal to a safe temperature.

When once coal in a cargo has fired, pumping in water is of practically no use, as the fire is, as a rule, near the bottom of the mass of coal, and the flow of the water is so impeded, that in percolating through the interstices of the heated coal, it is converted into steam before it can reach the seat of combustion. The most effective way to apply water would be to have four 3-inch pipes laid along the floor of the coal compartments, about 6 feet apart, these tubes having a ¼-inch hole bored in the upper side every foot or so, and each pair of pipes coming through the bulkhead, and connecting on to two 6-inch pipes passing through the side of the vessel, the sea water being prevented from entering by means of screw valves. As soon as the alarm thermometer gave notice that heating had reached a dangerous point, these valves could be opened and the lower portion of the cargo drenched with salt water. This, evaporating rapidly, would give large volumes of water vapor, which, passing up through the heated coal, would lower its temperature. It would be found beneficial to dress the coals with a little tar or tar oil, which would close the pores and to a great extent prevent oxidation.

The discussfon on Professor Lewes's paper was commenced by Dr. Elgar, who referred to a paper he read on "Losses at Sea" at the Liverpool meeting of the Institution in 1886. In that paper he had pointed out that the number of lives lost in coal-laden vessels, of over 300 tons, during the period of 1881 to 1883, was more than one-third of the total number lost in all the foundered and missing ships. The author stated in his paper that: "In the nine years immediately following the report of the Royal Commission on Spontaneous Ignition of Coal Cargoes, viz., 1875 to 1883, 57 coal laden vessels were known to have been lost from spontaneous ignition of their cargoes, while during the same perion 328 were missing from unknown causes, a large percentage of these losses being undoubtedly due to the same cause; and these again, form but a very small percentage of the cases in which the cargoes have heated and fired, but in which the vessels have been saved."

The speaker pointed out, with regard to the 328 vessels thus lost that there were other dangers attending coal cargoes besides spontaneous combustion, such as explosions of coal gas, shifting of cargo, collision, etc. From the paper he read at Liverpool, it would be seen that out of all the known losses registered during three years, 23 only were due to spontaneous combustion of coal, and of these 22 were sailing vessels, and only one a steamer. The speaker pointed out that many of the sailing ships thus lost were built of wood, and that wooden ships could not be kept dry, and he asked if the wet would not tend to generate heat in a coal cargo. Out of 86 coal laden vessels reported as foundered and missing, 33 were steamers and 24 of these went down with all hands. The remaining 9 were lost by springing leaks at sea or by shifting of cargo and taking in water through the deck openings. Sixteen of the remainder were iron sailing ships, and of these 11 went down with all hands, and 3 were lost through shifting of cargo. There were also 34 wood and 3 composite vessels. Dr. Elgar further pointed out that the firing of coal cargoes was not often the cause of loss of a ship or of the lives of the crew, notwithstanding the imminent peril in which ships are often placed in consequence. It took a considerable time for the fire to fully develop itself, and it appeared to be generally possible to get the ship into port. All ships registered in the United States were obliged by law to have steam pipes fitted throughout the holds for extinguishing fire, and the speaker was of opinion that some similar arrangement could be used with advantage in coal laden vessels.

CORNING, this State, is to have public electric lighting, the Mayor having been instructed to close a contract with the Corning Gas Company, under which the corporation is to maintain 50 arcs (1,200-candle power), to burn all night, and to be paid for at the rate of $100 each per annum. The contract is to last for 5 years, and the Company agrees to have the system in operation on July 1st.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. J. D. HIGGINS, Superintendent of the Rome (N. Y.) Gas Light Company, has completed the betterments to that plant, and the result is apparent at every gas burner tip in the city. He planned the scheme carefully and carried it out with dispatch.

AT the annual meeting of the South Side Gas Company, of Pittsburgh, Pa., the following officers were elected: President, George Trautman; Secretary, W. H. Aldred; Treasurer, W. L. Elkins, Jr.; Directors, George Trautman, W. H. Aldred, Robert Brown, M. Maloney, Geo. W. Elkins, Joseph Stewart, Dr. John M. Dixon, Joseph G. Walters and R. V. Messler.

MR. LEON APPERT not long since described before the Societe d'Encouragement (France) a method for manufacturing glass pipes of large size for the distribution of gases, liquids, etc., and claimed that under his system the mains could be manufactured at a fairly low cost. The advantages claimed for glass pipes in this connection are non-porosity and negative electric conducting property. Again, the smoothness and non-porous character of the material enable the pipes to be cleaned easily. The weight of the glass pipes, too, is not so great as that of cast or wrought iron pipes.

ACCORDING to the Burlington *Hawkeye*, from which paper the following particulars are taken, it is a settled fact that Burlington, Ia., is to have a fuel gas company. Continuing, our authority says: "That was settled on the 5th inst., when a body of influential citizens met at the parlors of the Commercial Club and associated themselves together and signed the articles of incorporation of the new Company. The latter will be known as the Citizens Fuel Gas and Lighting Company, of Burlington, Ia., and its object the manufacture and sale of gas for power, fuel, lighting and other domestic purposes to the citizens of this city and vicinity. For this purpose it shall have power to acquire, receive and hold from the city such franchises, charters and rights as may be agreed upon, including the right to occupy the streets and alleys and public grounds of the city for the laying down of street mains and the erection of public lamps; also to hold and acquire the necessary real estate, and generally to do and perform everything necessary to be done in order to properly and successfully establish, carry on, conduct and maintain the business proposed. The life of the Company began May 5th, and is to continue for 20 years. The authorized capital stock is $300,000, and the Company may commence business when $100,000 is subscribed. After commencing business new stock may be subscribed only as authorized by vote of the shareholders. Shares are of the value of $100. The Company is under the control and management of a Board of Directors, to be 5 in number. The officers will consist of a President, Vice President, Secretary and Treasurer. The annual meetings are to be held on the second Wednesday of January in each year. The highest indebtedness shall not exceed two-thirds of the capital stock, and the private property of the stockholders shall be exempt from corporate liabilities. The incorporators are W. D. Gilbert, M. A. Johnson, Chris. Mathes, Chris. Starker, James W. Smither, Chris. Geyer, D. D. Robinson, R. M. Raab, T. W. Barhydt and Philip M. Crapo. These names are a satisfactory assurance that the new Company is on a solid foundation and in the hands of men who will do all in their power to make the project a success. Mr. Branch, representing the Fahnehjelm Company, of Chicago, has been in the city in consultation with the present incorporators, and to him is due in great measure the success of the enterprise. This Company has offered entirely advantageous terms and has done everything possible to assure the members of the Burlington Company of the practicability and economy of the Fahnehjelm system. A petition was presented to the Council last nignt by Alderman Epstein setting forth the fact that the Company had been formed in answer to the popular demand for a cheaper illuminant, and that the Burlington Gas Light Company had declared they could not furnish their product at lower prices than now received. They, therefore, asked that a Committee of the Council be appointed to confer with the Fuel Gas Company for the propose of determining what franchise, contracts, rights or other privileges could be granted the new Company. The committee appointed consists of Messrs. Epstein, Mercer and Bonn, who may be depended upon to make every reasonable concession to the new Company. It is the expectation that a franchise will be asked for at the next regular meeting of the Council. We believe but few realize fully the significance of the step taken by the Fuel Gas Compony. Not only will the cost of gas for fuel and illumination be cut in halves, which will effect a large saving to the consumer, but manufacturers will be attracted to a place

where they can obtain such a low priced, pure and convenient fuel. It is a matter upon which the city as a whole may well congratulate itself not only for the direct benefits to be derived, but as an evidence of the enterprise and prosperity of her citizens. This is a trump card, which commercial agent Merrill will not fail to play to advantage in his approaching onslaught on the eastern manufacturers. No one is more delighted over the result than Mr. Merrill. He has labored assiduously to bring it about, and is now planning how to make use of it to further other interests. We welcome the new Company, and predict for it a brilliant and prosperous career." All of which is submitted as evidence that it is easy to gull some folks, even though the latter be engaged as newspaper agents in promoting the "best interests of an enterprising city!" The delightful childishness of the Hawkeyed Man, in respect at least to the blessings disguised in the shape of opposition gas charters, is simply touching. The old Company that knows to a dot the capacity for gas absorption of the city, cannot sell gas at anything like the figures that new hands to the business in the district are prepared to dispose of it when "they are ready," etc. Mr. Branch, we are told, "has done everything possible to assure the members of the (new) Burlington Company of the practicability and economy of the Fahnehjelm system. "Well, why could not Mr. Branch have used his powers of persuasion on the old Company, that was already in the field." Perhaps this might be answered in the remark that the old Company already knew the flimsiness of the wares that Mr. Branch had for sale; again, that Mr. Branch thought with good reason he would have better success with "green enthusiasts" than with seasoned operators. The long and short of it is that Burlington is to be appealed to to support a set of schemers, who have, however, so far not been very successful in the matter of "finishing" their dupes. In taking leave for the present of this case we must say we are one with our *Hawkeye* cotemporary in his belief that "but few realize fully the significance of the step taken," etc.; they will, however, get a better appreciation of the step and its tendency at some future time, say, for instance, when the final settlement is made in the adjustment between the conflicting capitalists—always providing that the Fuel Gas Company will assume other shape than that of an enterprise on paper.

MR. W. W. PRICHARD, of the Ironton (Ohio) Gas Company, writing under date of the 8th inst., says that there is nothing either new or strange in the gas business in his locality. Business there, however, is good, with a satisfactory increase over last year.

DISPATCHES from Peoria, Ills., say that Governor Hill, of New York, has granted the requisition asked for in the case of Lafayette Cole, who is charged with absconding with $6,000 of the moneys of the Peoria Gas Light Company, of which corporation he was Secretary and Treasurer. Cole, after a preliminary hearing, was admitted to bail in $7,000.

AT the annual meeting of the stockholders of the Cincinnati (Ohio) Gas Light and Coke Company the only change made in the former Board of Directors was the selection of Samuel J. Broadwell to fill the vacancy occasioned by the death of T. D. Lincoln.

THE proprietors of the Woodstock (Vt.) Gas Company have at last determined to rearrange and improve their distributing system.

"THE stockholders of the Perth Amboy (N. J.) Gas Light Company held their annual meeting on the afternoon of the 5th inst., and the following gentlemen were in attendance: Patrick Connery, J. Kean, Jr., U. B. Watson, Wm. Hall, Geo. A. Seaman, N. C. J. English, David Hayes, J. L. Kearney, W. H. McCormick, Wm. Ahrens and M. A. Brown. After the reading of the annual reports, the first five on the above list were nominated and elected Directors for one year. At a subsequent meeting of the Directors Mr. Connery was elected President, and Mr. Hall Secretary and Treasurer. Messrs. Watson and Seaman were instructed to consider and report on the advisability of engaging a Superintendent. I am pleased to note this determination, even though it is arrived at at a rather late period.—R. T. S."

Mr. A. G. Glasgow, who has been connected with the Kansas City (Mo.) Gas Light and Coke Company for the past two years, has resigned in order to take the General Inspectorship of the United Gas Improvement Company. He is succeeded in Kansas City by Mr. Geo. S. Clarke. A notable incident connected with Mr. Glasgow's departure from Kansas City was his reception at the depot, just before the arrival of the train that was to convey him East, by a deputation of employees from the Gas Company, who handed him a handsome silk umbrella. Mr. Clarke made the presentation speech, and to say that Mr. Glasgow was surprised over the affair is to put it very mildly.

THE following explains itself: "ST. JOSEPH GAS AND MANUF'G CO., ST. JOSEPH, MO., MAY 5, 1890.—Dear Sirs:—I have this day resigned the position, heretofore held by me in this Company, of Secretary and Treasurer, in order to devote all my attention to my own business in St. Louis, Mo., where I shall hereafter be associated with Mr. John G. McNair, in real estate and loans. I bespeak for my successor, Mr. Jas. O. Starks, the same kindness you have always extended to me in my business relations. Very truly yours, J. H. FARISH." We are sorry to lose Brother Farish from the ranks, and Mr. Starks can always command us.

A SLIGHT fire occurred on the 6th inst., in the generator room of the Jackson (Mich.) Fuel Gas Company's plant. The damage was confined principally to the roof. Loss about $600.

THE annual meeting of the Metropolitan Gas Light Company, of Elizabeth, N. J., resulted in the following choice of officials: Directors, Chas. G. Francklyn, Richard Irwin, John W. Gordon, W. Lewis Boyle, G. Wredenfield, C. K. Dutton, W. M. Oliver, Jas. S. Green and Henry Mactier; President, Chas. G. Francklyn; Secretary, W. M. Oliver; Treasurer, Wm. F. Van Pelt. The determination was reached to go right on with main extensions, and it was the general opinion of the officials that the Company would be ready to supply gas on July 1st. September 1st would be nearer the mark, we think.

THE mains of the New Britain (Conn.) Gas Company are being extended through Bassett, Division, South Main, Whiting and Maple streets. In fact, from the reports that we have of work of this kind from almost all sections of the country, it would seem as if we were to have a regular boom in the matter of increased sendout.

THE capital stock of the Mansfield (Ohio) Gas Light Company has been increased to $150,000 from $90,000.

AT the annual meeting of the Altoona (Pa.) Gas Company, the following officers were chosen: President, John Lloyd; Treasurer, W. D. Couch; Managers, W. H. Wilson, Enoch Lewis, H. C. Dern, T. Blair Patton and R. E. Pettit.

THE Syracuse (N. Y.) Gas Light Company, as an earnest of its disposition to deal in the future as it has in the past with the residents of its city, is out with an announcement that on and after June 1st the gross rate to ordinary consumers will rule at $1.60 per 1,000 cubic feet, subject to a discount of 20 cents per 1,000 when bills are paid on or before the 15th of the month in which they are presented. The price to the city is to rule at $1.30 per 1,000. We congratulate the Company and its guiding genius, Mr. A. C. Wood, on this latest proof of good business management.

THE employees of the Peoples Gas Light Company, of Manchester, N. H., have demanded an increase of wages, the increase asked for averaging about 25 cents per day. The proprietors are averse to granting the concession, and the men assert that if their demand is not acceded to a strike will be the result.

MR. CHARLES MONSON, of New Haven, Conn., who died at his home in that city on the 5th inst., at the advanced age of 90, will be remembered by gas men as the inventor of the extension gas fixture. He was a brother of the late Dr. Alfred Monson.

AT the annual meeting of the Bangor (Me.) Gas Company the following Directors were elected: T. U. Coe, F. A. Wilson, A. C. Hamlin, C. P. Stetson and John F. Colby. At the Directors' meeting the following officers were chosen: President, T. U. Coe; Secretary, W. S. Dennett; Clerk and Treasurer, Henry Boardman; Superintendent, A. H. Parker. The Company prospers despite the attempted competition of electric lighting.

THE "small boy" and the larger hoodlum in the Wollaston district of the Quincy (Mass.) Gas Company possess a decided antipathy to glass-encased gas lanterns, for the breakage to the latter is simply enormous. The Company, however, must be to blame for this state of affairs, since it could easily under the law bring the offenders to their senses. The Public Statutes, chap. 203, sec. 76, provide that "whoever wilfully or maliciously extinguishes a lamp, or breaks, or mutilates, or destroys, or removes a lamp or lamp post erected on a bridge, sidewalk, street, high-

way, court or passage, shall be punished by imprisonment in the jail not exceeding 6 months, or by a fine not exceeding $50."

THE Pacific Gas Engine Company has been incorporated at San Francisco, Cal., by Messrs. Wm. G. Barrett, C. L. Barrett, E. C. Bartlett, W. A. Cavanaugh and John L. Boone. It is capitalized in $100,000.

BECAUSE of the fall of an elevator at the Potrero Station of the San Francisco gas works two employees (Terence Hoey and Edward Kelly) were badly injured. While ascending the elevator, which was raising a heavy load of coal, at a height of 30 feet above the ground, a part of the machinery gave way and the men were thrown to the bottom of the shaft.

AT a meeting of the stockholders of the Peoples Gas and Gaseous Fuel Company, of Harrisburg, Pa., the following Directors were elected: David Flemming, Jr., T. D. Greenawalt, W. T. Hildrup, W. W. Jennings, S. J. M. McCarrell, W. T. Hildrup, Jr., Wm. T. Kirk. The officers chosen were: President, David Flemming, Jr.; Secretary and Treasurer, Geo. R. Flemming.

MR. COSTIGAN brought up recently before the Canadian Parliament another gas inspection amendment act. The bill as at first proposed called for an inspection of gas meters every 5 years; but he explained that he had decided instead of taking this means of increasing the revenue to increase the fees and leave the time of inspection as at present. He asserted that the deficiency in the revenue was about $30,000. Mr. Jones advised Mr. Costigan to leave the matter alone, as there was a surplus in the treasury, and economy, which did not seem to be a marked virtue in the Department, might be practiced as a means of equalizing revenue and expenditure. Mr. Mitchell indorsed Mr. Jones' view on the ground that this would simply mean a tax upon consumers. As the 5 years' inspection system was to be continued, a mere increase in fees would not lead to an improvement in the accuracy of meters. Means, he thought, should be taken to compel the gas companies that made great dividends on watered stock to supply better gas. Mr. Lister denied that the gas companies in the smaller towns made other than fair dividends, and as this bill seemed a means of harassing the companies, he also advocated leaving the bill over. It was, however, not only read a second time, but was also put through its final stages.

TREASURER RICHARDSON, of the North Adams (Mass.) Gas Company, informs us that he is just completing the new electric annex to the Company's possessions, the buildings for which have been erected close to the generating house of the gas plant. The electric equipment comprises three 45 arc light machines and one 500-light alternating incandescent machine, all of the Thomson-Houston type. A 150-horse power Hazleton boiler is to furnish the power, and the apparatus has been most carefully placed. On May 5th the Company was awarded a contract for the public lighting of North Adams for a period of 3 years, on the basis of 70 arcs, to be paid for at the rate of 30 cents each per night, the lights to burn every night and all night. In the meantime we might remark that Treasurer Richardson does not intend to push electric lighting at the expense of his gas sendout, which continues to increase in gratifying percentage. This leads us to say that Treasurer Richardson is to be congratulated over the fact that the gas sendout in North Adams this year will not be less than 22 millions cubic feet, which is just 5½ times more than the quantity sent out in 1880. The selling rates, also, have been decreased from $3, in 1880, to $1.65 to $1.85 at the present time. The distributing system of the Gas Company will be increased this season by the placing of 1½ miles of 6 and 10-inch pipes.

THE visiting gas man to this city who will have occasion to hunt up the local headquarters of the Goodwin Gas Stove and Meter Company, must bear in mind that Manager Edwards has removed himself and his shingle from 142 Chambers street to No. 113 same street.

WE are indebted to "Observer" for the following, which is from the Manchester *Mirror and American*, of the 10th inst.: "Manchester has been congratulating herself for several months that among all the manufacturing and industrial centers of the country she alone had been spared by the professional agitator and his inevitable accompanist, the prolonged strike. The fond delusion that on account of previous exemption she would escape from any future labor trouble was rudely shattered early this afternoon by the announcement, which spread with the utmost rapidity, that the employees of the Peoples gas works had gone out on a strike. The affair, as is natural in such cases, was grossly exaggerated, and from rumors flying about one would have been led to believe that the whole of South Manchester had knocked off work. Investigation soon revealed the true condition of things, and although matters at the works are bad enough this afternoon, the state of affairs is much less ominous than was at first given out, and owing to the energetic efforts of Agent W. G. Africa the trouble promises to be tided over with but little, if any, inconvenience to the general public. The history of the strike is as follows: For some time there has been a growing feeling of discontent among the employees of the works over the wages paid by the Company. The men, so one of them informed the newspaper man that investigated the subject, had to work 13 hours per day, and as their duties were both of an arduous and confining nature, it told on their systems to a remarkable extent. Add to this the fact that a portion of their labors had to be performed in the night and a part in the day, practically spoiling the entire 24 hours, the informant stated that the men feel they have a grievance and one that could only be remedied by the addition of at least $1.75 per week to their pay, and they had accordingly requested Mr. Africa to raise their wages from $2 to $2.25 a day. There appears to be some discrepancy about the time set for this raise to go into effect between the statements of the men and that of the Agent; but in any event matters were brought to a head at noon of to-day, by 26 of the employees of the works banking their fires and leaving the establishment in South Manchester to itself. The entire force on duty, with the exception of a few yard hands, are included in the ranks of the strikers, and hence, while their numbers may be small, their importance as a factor in furnishing Manchester's illuminating vapor makes the strike as formidable as many in which larger bands of breadwinners have an interest. Mr. Africa was seen with reference to the situation, and expressed himself in forcible terms as to the attitude of the Company. 'There will be no surrender,' said he; 'not even a compromise. We raised the pay of these employees, when the Peoples Company took charge of the plant, from $1.75 to $2, and that is all that we shall pay. We can get men enough to work for these wages that are competent to fill the position.' Mr. Africa further asserted, in reply to inquiries, that the men had applied to him yesterday for the proposed increase, and that on his refusal to grant the raise they had all given a two weeks' notice, which they abruptly terminated this noon, as seen above. With reference to the supply of gas now on hand, Mr. Africa stated that the daily consumption in the city amounted to 240,000 cubic feet, and that the stored supply could be made to last 3 days. He had also at the works at the South End a water gas plant, on the use of which injunction proceedings are now pending. He has telegraphed to Philadelphia and got this injunction raised temporarily, and if he cannot secure men enough to run the coal gas plant within the necessary 3 days, he will put his water gas apparatus into action and furnish the city with gas of that sort until the present difficulty is abated. One man with 2 helpers can, in one-half day, make gas enough to last the public a whole day, so that there does not appear to be much danger of this supply giving out. The above is the situation, with both sides standing firm, at the hour of going to press."

THE bonds of the Grand Forks (N. Dak.) Gas Company have been purchased by Messrs. E. H. Rollins & Sons. The price paid was at the rate of 80 per cent.

THE site for the new gas plant at Florence, Ala., has been selected. It is quite close to the local depot of the Louisville and Nashville Railroad.

THE Central Gas Improvement Company, to manufacture and distribute gas and electricity for lighting and other purposes, has been organized in Chicago by Messrs. Calvin Dickey, G. M. Trowbridge and J. O. Noris. It is capitalized in $100,000.

GENERAL MANAGER MCMILLAN, of the La Crosse (Wis.) Gas Company, is meeting with great success in his plan of introducing gas stoves, large numbers of which are now in use in his city. Being a believer in the efficacy of printer's ink, he has availed himself largely of the columns of the local papers for the purpose of displaying the different styles of cooking and heating stoves, hot water heaters, etc. For instance, half of the front page of the *Republican and Leader* has for some time been devoted to a handsomely illustrated advertisement, in which nine well arranged cuts display as many different styles of cooking and heating devices. Mr. McMillan's plan of booming the stove trade is so unique that we herewith give a summary of it. Stoves to the number of 100 will be virtually given away on the following basis: The purchaser selects the style of stove desired, when the Company will set it in place and properly connect it with gas. The stove will be billed at an agreed-on price, and the connections will be charged for at cost. As soon as the bill is paid the gas will be turned on, whereupon the stove

becomes the property of the consumer. Gas may then be used for any purpose without charge until the quantity so consumed, at $2 per 1,000 cubic feet, will equal in value the amount advanced for stove and connections, after which bills for gas will be made out at $1.50 per 1,000, and collected monthly in the usual manner. Surely, that is a liberal proposition.

MESSRS. GEORGE A. BROOKS AND HENRY MCGURRIN have laid before the Council of Norfolk, Neb., the following proposition, which is favorably viewed by the authorities: The contractor to expend $65,000 in the construction of a gas plant, if the city will agree to contract to take gas for 25 public lamps the first year, 50 the second, 75 the third, and 100 the fourth and fifth years after the completion of the plant.

THE officers of the Roanoke (Va.) Gas and Water Company are: President, F. J. Kimbell; Secretary and Treasurer, H. E. Gerhard; Manager, J. C. Rawn.

MESSRS. W. Z. LARNED, C. A. Du Vivier, W. H. De Forest, George Manley, and Jonathan Bonnel, have given notice as incorporators of the Summit (N. J.) Gas Light Company, the enabling act for which was passed by the Legislature in 1873, that subscription books have been opened, and that subscriptions for the shares will be received to-day at the office of Mr. A. L. De Coster, township of Summit. It is understood that the majority of the stock will be taken by the proprietors of the Citizens Gas Light Company, of Newark, under whose auspices the new plant will be constructed.

Ingenious Expedient in Hydraulic Engineering.

F. S. Pecke, a civil engineer at Watertown, N.Y., lately accomplished in a very simple, cheap and expeditious way what is usually a difficult and expensive operation—the laying of a long line of pipe in deep water. He had occasion to lay nearly 1,000 feet of suction pipe at Rouse's Point. The water was needed for manufacturing purposes, and as it was found that water near the shore was more or less roily and impure, it was necessary to have the inlet a considerable distance out into the lake. He purchased for the purpose a steel pressure pipe of 8-inch diameter, manufactured by the Spiral Weld Tube Company, at East Orange, N. J., and used for couplings cast iron flanges, weighing, with bolts and gaskets, about 65 pounds to the pair. Plugging the end of the first length he pushed it out on the surface of Lake Champlain and connected the second length; pushing this out in turn until the whole line was coupled. It then presented the unusual spectacle of a line of 8 inch pressure pipe, nearly 1,000 feet long, floating with a displacement of only 3½ inches of its diameter. When the requisite length had been connected, the line was towed to position, the plug at the end removed, and the pipe sank easily in 16½ feet of water, without breaking a joint or receiving any injury. No buoys or floats were used in the operation, and no apparatus of any kind. The pipe is now in use as the suction of a steam pump, and gives perfect satisfaction. Work of this kind usually involves the use of expensive and troublesome flexible joints, and Mr. Pecke's ingenious expedient is worthy of record.

Useful Memoranda and Information for Engineers.

Loss of Water by Waste.—Water leaking through a hole just large enough to pass a needle through during 24 hours at a 14-pound pressure would be sufficient to supply a house for the day. The waste through a ¼-inch pipe under the same conditions would be 1,140 gallons.

An experienced inspector says: The most common defects to be found about the engine come from improper working or regulation by the governor, as the journals and bearings of the governor are quickly worn out if not looked after. The governor should be regularly cleaned, washed off and well lubricated. Engineers often think that their pistons and valves are not working to the best advantage, when the fault is really with the governor. Sometimes pistons leak, an effect of unequal and excessive wear. Belts being too tight cause a deal of trouble, a little sag being a good thing for bearings, as they very often get hot because the belts draw too tight.

As to boilers, laminated plates over furnace and bridge wall cause endless trouble, complaints from this outnumbering all others. The next thing to demand notice is deposit, which 90 per cent. of boilers are subject to. This causes bagging, burnt plates, opened seams and rivet checks.

Another bad fault comes from having feed and blow of the boilers at the front end. This allows the back end to become covered with sediment due to poor circulation. This should never be so. There should always be some means by which the boilers can be thoroughly cleaned and inspected. The man-hole plate in the front head is an excellent thing.

Another great fault in construction is not leaving room enough to clean boilers. Where there is any trouble or labor in getting at the parts the engineer does not give the boiler the attention it requires, and will not clean any more than is actually necessary, but where parts are easily accessible, and there is no trouble in keeping the same in good condition, the engineer will take pride in this part of his work.

Circular bridge walls should be condemned, for the reason that they are of no use and do not add to the combustion. As the fire is perfectly level—the bridge wall should also be level—that part of the shell directly over the bridge wall can be readily examined by the engineer or inspector at any time.

Steam gauge pipes should also have stop-cocks and blow-off cocks, so that the sediment and dirt can be blown out of the gauge pipes, the gauge taken down, tested and replaced while there is steam on the boiler.

Many boilers are injured by having fire lines too high—that is, above the gauge cocks; this will cause cracks, lamination and checks. The metal should not be exposed to fire where there is no water on the opposite side.

After the engineer gets the engine working well and in good order he should not tinker with it, but let him put his screw wrench on the shelf and not take it down until it is actually necessary.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Gas Companies Should Control the Introduction of Gas Stoves.

CHICAGO, ILLS., May 13, 1890.

To the Editor AMERICAN GAS LIGHT JOURNAL:

In answer to numerous inquiries and letters asking my views regarding the above proposition, I thought it best to briefly submit through your JOURNAL, not only my own opinion but such information as I have gathered from gas companies and the fraternity at large, offering the same for what it may be worth. In the past few years, in the way of business, I have visited nearly every gas company in the country, and have done considerable missionary work in the gas stove field by persuading companies to buy out the stock of stoves from local dealers and operate themselves, and I have yet to learn of a single instance where the company failed to make the system a success. I give you a few reasons why gas companies should manage the stove trade.

1st. It is the gas company's interest to increase the day consumption of their product. That means increased profits and larger dividends, as well as the regular and economical working of apparatus, lessening cost of production, wear and tear, repairs, etc.

2d. For a gas stove to work successfully it should be properly connected to the right sized pipes, and necessary instructions imparted how to use it. Adjust the burner to economize the gas and have perfect combustion, and other minor points adequate to satisfy the purchaser. All gas stoves and ranges must be looked after when complaints are made, and it is imperative that they be kept clean. None are better qualified to attend to these details than employees of gas companies, who usually are experts, and have all the facilities. It should be made a part of their duties.

3d. Many companies in view of these considerations are offering very liberal inducements to encourage the consumption of gas as fuel by granting a reduced rate, selling at wholesale price, when used in large quantities; also by selling gas stoves at cost prices, piping them with a separate meter attached free of charge. In some cities the company manufacture their own stoves and rent them out at a low rental by the month. Some operate a stove store detached from their business, and, as before stated, these methods have invariably proven successful. Some recent experience in introducing hotel ranges on a large scale has forcibly impressed the necessity of having expert gas men to see to having stoves and ranges properly set up, kept clean, and educate the novice how to operate them.

The consumer may soon, when that happy millenium arrives, come to the gas office with smiles, and instead of imprecations shower blessings on the gas people as public benefactors, paying his increased gas bill without a murmur; and, of course, we as manufacturers of gas stoves cannot help from cheerfully joining with the public and sing a hozanna of praise to the gas fraternity. Very truly yours, S. S. STRATTON.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR—Jos. R. Thomas, C.E.
ASST. EDITOR—T. J. Cunningham.
MANAGER—C. E. Sanderson.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.

This is a recognized official organ of
LIGHT, HEAT, STEAM, WATER SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE

TERMS:
SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 cents.

AGENTS.
NEW YORK.—AMERICAN NEWS CO., 39 and 41 Chambers Street.
PHILADELPHIA.—PRATT & CO., Corner Ninth and Arch Streets.
Germany.—B. WESTERMANN & CO., of New York.

MONDAY, MAY 19, 1890.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.
16 WALL ST., NEW YORK CITY.
MAY 19.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	105¾	—
Central	500,000	50	85	95
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	122½	123
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	115	120
Mutual	3,500,000	100	115	118
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co —				
Common Stock	5,000,000	100	—	45
Preferred	5,000,000	100	84	87
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	111	117
Citizens	1,200,000	20	75	—
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	127	130
" Bonds	300,000		100	105
Peoples	1,000,000	10	86	88
" Bonds (5's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	102	—
Nassau	1,000,000	25	120	—
" Ctfs	700,000	1000	100	102
Williamsburgh	1,000,000	50	125	—
" Bonds	1,000,000	—	110	112
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	93	93½
2d " " "	3,000,000	1000	71	72
Bay State Gas Co.—				
Stock	5,000,000	50	83	84
Income Bonds	2,000,000	1000	—	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	63¼	—
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	100	97½	98¼
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	94⅞	95½
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	96	100
Consumers Gas Light Co., Jersey City	2,000,000	100	20	—
Bonds	600,000	1000	80	—
Cincinnati G. & C. Co.	6,000,000	100	201	203
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal.			80	90
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	52	52¼
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	75	90
Bonds	250,000		—	—
Hartford, Conn.	750,000	25	102	108
Jersey City	750,000	20	170	175
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	27¼	—
Preferred "	2,500,000	100	64	70
Bonds	9,034,400	1000	87	88

Advertisers Index.

GAS ENGINEERS. Page
Jos. R. Thomas, New York City ... 717
Wm. Henry White, New York City ... 723
Wm. Mooney, New York City ... 717
William Gardner, Pittsburgh, Pa. ... 717
Fred. Bredel, N. Y. City ... 719

GAS WORKS APPARATUS AND CONSTRUCTION.
James R. Floyd & Sons, New York City ... 723
Continental Iron Works, Greenpoint, L. I ... 723
Deily & Fowler, Phila., Pa ... 723
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 720
Stacey Mfg. Co., Cincinnati, Ohio ... 723
Bartlett, Hayward & Co., Baltimore, Md ... 721
Morris, Tasker & Co., Limited, Phila., Pa ... 721
Davis & Farnum Mfg. Co., Waltham, Mass ... 720
R. D. Wood & Co., Phila., Pa ... 722
Bouton Foundry Co., Chicago, Ills ... 723
Smith & Sayre Manufacturing Co., New York City ... 722
Fred. Bredel, N. Y. City ... 719
United Gas Improvement Co., Phila., Pa ... 713
National Gas Light and Fuel Co., Chicago, Ills ... 710
Simpkin & Hillyer, Richmond, Va. ... 707

GAS AND WATER PIPES.
Gloucester Iron Works, Phila., Pa ... 717
Mellert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 717
Ohio Pipe Co., Columbus, Ohio ... 717
M. J. Drummond, New York City ... 717
R. D. Wood & Co., Phila., Pa ... 722
Warren Foundry & Machine Co., New York City ... 717
Donaldson Iron Co., Emaus, Pa ... 717
Dennis Long & Company, Louisville, Ky ... 717

PROCESSES.
National Gas Light and Fuel Co., Chicago, Ills ... 710
Bartlett, Hayward & Co., Baltimore, Md ... 721
Wm. Henry White, N. Y. City ... 723
United Gas Improvement Co., Phila., Pa ... 713
The Fuel Gas and Light Improvement Co., N. Y. City ... 708

INCLINED RETORTS.
Laclede Fire Brick Manuf'g Co., St, Louis, Mo ... 708

GASHOLDER TANKS.
W. C. Whyte, New York City ... 710
J. P. Whittier, Brooklyn, N. Y ... 715

GASHOLDER PAINT.
The Government Waterproof Paint Co., Boston, Mass ... 707

RETORTS AND FIREBRICK.
J. H. Gautier & Co., Jersey City, N. J ... 718
B. Kreischer & Sons, New York City ... 718
Adam Weber, New York City ... 718
Laclede Fire Brick Manuf'g Co., St. Louis, Mo ... 718
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 718
Borgner & O'Brien, Phila., Pa ... 718
James Gardner, Jr., Pittsburgh, Pa ... 718
Henry Maurer & Son, New York city ... 719
Chicago Retort and Fire Brick Co., Chicago, Ills ... 718
Baltimore Retort and Fire Brick Co., Baltimore ... 718
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo ... 718
Boston Fire Brick Works, Boston, Mass ... 718

SCRUBBERS AND CONDENSERS.
G. Shepard Page, New York City ... 712
R. D. Wood & Co., Phila., Pa ... 722

REGENERATIVE FURNACES.
Bartlett, Hayward & Co., Baltimore, Md ... 721
Fred. Bredel, New York City ... 719
Chicago Retort and Firebrick Co., Chicago, Ills ... 718
J. H. Gautier & Co., Jersey City, N. J ... 719

GAS GOVERNORS.
Connelly & Co., New York City ... 715
Fred. Bredel, N. Y. City ... 719
Friedrich Lux, London, England ... 707

SELF-SEALING MOUTHPIECE DOORS.
Smith & Sayre Mfg. Co., New York City ... 722

TAR AND CARBONIC ACID EXTRACTOR.
Geo. Shepard Page, N. Y. City ... 676

CEMENTS.
C. L. Gerould & Co., Brooklyn, N. Y ... 718

GAS ENRICHERS.
Standard Oil Co., Cleveland, Ohio ... 724

GAS METERS.
John J. Griffin & Co., Phila., Pa ... 726
American Meter Co., New York and Philadelphia ... 727
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa ... 727
Helme & McIlhenny, Phila., Pa ... 727
D. McDonald & Co. Albany, N. Y ... 727
Nathaniel Tufts, Boston, Mass ... 726
Maryland Meter and Manufacturing Co., Baltimore, Md ... 672
Bell & Jones, Philadelphia, Pa ... 726
Harris Bros. & Co., Philadelphia, Pa ... 726

EXHAUSTERS.
The P. H. & F. M. Roots Co., Connersville, Ind ... 714
Smith & Sayre Manufacturing Co., New York City ... 722
Wilbraham Bros., Philadelphia, Pa ... 715
Connelly & Co., New York City ... 715

GAS COALS.
Penn Gas Coal Co., Phila., Pa ... 725
Perkins & Co., New York City ... 724
Newburgh Orrel Coal Co., Baltimore Md ... 725
Despard Coal Co., Baltimore, Md ... 725
Chesapeake and Ohio R. R. Coal Agency, N. Y. City ... 725
Westmoreland Coal Company, Phila., Pa ... 725
J. & W. Wood, New York City ... 724

CANNEL COALS.
Perkins & Co., New York City ... 724
J. & W. Wood, New York City ... 724

VALVES.
Ludlow Valve Manufacturing Co., Troy, N. Y ... 716
John McLean, New York City ... 716
Chapman Valve Manufacturing Co., Boston, Mass ... 716
R. D. Wood & Co., Phila., Pa ... 722
The P. H. & F. M. Roots Co., Connersville, Ind ... 714

GAS ENGINES.
Schleicher, Schumm & Co., Phila., Pa ... 728
Clerk Gas Engine Co, Phila., Pa ... 716
Van Duzen Gas Engine Co., Cincinnati, Ohio ... 716

ENGINES AND BOILERS.
Jarvis Engineering Co., Boston, Mass ... 715
Ball Engine Co., Erie, Pa ... 707

STEAM PUMPS.

Van Duzen & Tift, Cincinnati, Ohio.... 707

GAS LAMPS.

Welsbach Incandescent Gas Light Co., Phila., Pa..... 709
The Siemens-Lungren Company, Philadelphia, Pa..... 709
Fiske, Coleman & Company, Boston, Mass..... 718

PURIFIER SCREENS.

John Cabot, New York City.. 716
Bartlett, Hayward & Co., Baltimore. Md..... 716

GAS STOVES.

American Meter Co., New York and Philadelphia..... 711
The Goodwin Gas Stove and Meter Co., Phila. Pa 692
George M. Clark & Company, Chicago, Ills..... 709
D. McDonald & Co., Albany, N. Y..... 727
Maryland Meter and Manufacturing Co., Baltimore, Md.... 672
Bell & Jones, Philadelphia, Pa..... 726
Chicago Gas Stove Company, Chicago, Ills..... 708

STREET LAMPS.

J. G. Miner, Morrisania, New York City..... 707
Bartlett Street Lamp Man'fg Co., New York City..... 707

BURNERS.

C. A. Gefrorer, Phila., Pa..... 724
H. W. Rappleye, Philadelphia, Pa..... 368

STEAM BLOWER FOR BURNING BREESE.

H. E. Parson, New York City. 716

PURIFYING MATERIAL.

Connelly & Co., New York City..... 715
Friedrich Lux, London, England..... .. 707
Edgewater Lime Works, Edgewater, N. J..... 708

COKE CRUSHER.

C. M. Keller, Columbus, Ind..... 725

ELECTRICAL APPARATUS.

Wm. Henry White, N. Y. City..... 723

BOOKS, ETC.

Gerould's System Gas Bookkeeping..... 707
1 90. Directory. 1890 715
King's Treatise 717
Scientific Books 719
Management of Small Gas Works..... 716
Gas vs. Electricity..... 672
Practical Electric Lighting 715
Electric Light Primer..... 715
American Gas Engineer and Superintendents' Handbook... 725
Digest of Gas Law..... 671
Fuel and its Applications 671
Newbigging's Handbook 719

WANTED,

By an experienced man,

Situation as Inspector.

Thoroughly competent in all branches of distribution work.

780-2 Address INSPECTOR, care this Office.

Position Wanted

As Superintendent or Assistant of a Gas Works,

By a man who can give the best of references. Thoroughly understands the manufacture and distribution of gas and the construction of works. Address

779-5 "M.," care this Journal.

POSITION WANTED

As Superintendent of Gas Works.

Eleven years' experience in the manufacture of coal gas. Best of references given.

W. L. CARVER, Supt.,
778-8 Carthage, Mo.

FOR SALE,

The Ironwork for Twelve Benches of 6's, viz.:
Cast Iron Hydraulic Main.
7-inch Dip-Pipes, Stand-Pipes, and Bridge-Pipes, complete.
Floyd Mouthpieces and **Self-Sealing Lids,** 15x36 in.

Lids and Mouthpieces only in use over a year. Will be sold cheap.

ISAAC C. BAXTER,
772-tf Detroit (Mich.) Gas Lt. Co.

WANTED,

By a New England Gas Company,

A Man to Repair Meters, take Meter Readings, etc.

776-5 Address "H. R.," care this Journal.

GEROULD'S
System Gas Bookkeeping.

Approved and adopted by many of the prominent Gas Engineers of the Country.

Sample Sheets and Price-List furnished free on application to

L. P. GEROULD, - - Mendota, Ill.

FRIEDRICH LUX,

Ludwigshafen am Rhein and London.

Lux Mass,
GAS GOVERNORS,
Gas Balance.

Simpkin & Hillyer

RICHMOND, VA.

MANUFACTURERS OF

Gas Works Apparatus

BENCH CASTINGS, CONDENSERS,

Scrubbers, Purifiers, Dry Center Seals,

FOUR-WAY VALVES, GAS VALVES,

SULPHATE OF AMMONIA APPARATUS,
TANKS, ENGINES, BOILERS,
PUMPS, ETC., ETC.

Plans, Specifications and Estimates furnished for new works, or alteration of old works. Correspondence solicited. Works Newport News, Va.

Bartlett Street Lamp Mfg. Co.

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

40 & 42 COLLEGE PLACE, - - N. Y. CITY.

Gas Companies and others intending to erect Lamps and Posts will do well to communicate with us.

The Miner Street Lamps.

Jacob G. Miner,

No. 823 Eagle Ave., New York, N. Y.

VAN DUZEN'S
STEAM JET PUMP

For Water Supply Tanks.
For Fire Pump on Yard or Switch Engines.
For Round House General Work.
For Draining Ponds, Pits, Coffer Dams, etc.
10 Sizes. $7 to $75. Thousands in use.

Write for Descriptive Book to VAN DUZEN & TIFT, 106 E. Second St., CINCINNATI, O.

GASHOLDER PAINT.

Use Only

THE GOVERNMENT WATERPROOF PAINT.

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

THE GOVERNMENT WATERPROOF PAINT CO., 122 Milk Street, Boston, Mass.

F. D. HARMON, Pres. CHAS. C. ALLEN, Sec. and Treas. P. W. MACKENZIE, Chief Engr.

THE FUEL GAS AND LIGHT IMPROVEMENT CO.

OF AMERICA.

Owner of the Mackenzie Patents of Dec. 31, 1889, and later dates.

For the United States, England, Russia, France, Germany, Austria, and Canada,

No. 32 Park Place, New York City.

This SYSTEM is an ABSOLUTELY NEW DEPARTURE IN THE MANUFACTURE OF FUEL AND ILLUMINATING GAS.

The COST OF GAS IN THE HOLDER by our System is at least THIRTY PER CENT. LESS than that made by any other process of he day. The Gas contains neither SULPHUR nor other impurities, nor is there any resultant LAMPBLACK OR TAR RESIDUUM.

The Gas is manufactured WHOLLY from LIQUID HYDROCARBONS, such as Lima, Penn. Crude, and Fuel Oils, Naphtha, etc.

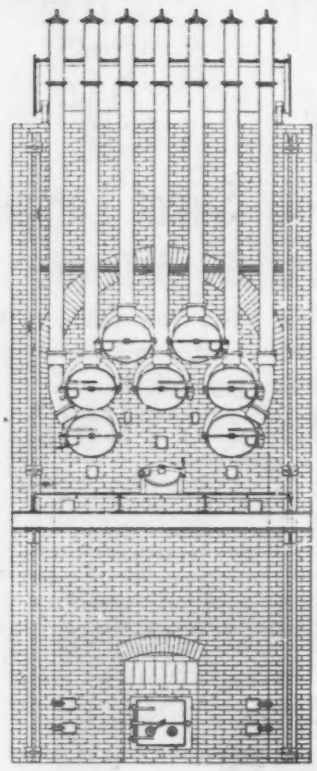
Neither PERISHABLE PIPES nor other RETORTS, NOR THEIR EQUIVALENTS, are used.

Neither COAL, COKE, nor any other HARD CARBONS enter into the manufacture or composition of the Gas, thereby requiring LESS LABOR THAN ANY OTHER METHOD. The APPARATUS is extremely SIMPLE, SUBSTANTIAL, and DURABLE.

Works under our system may be CONTINUOUS or ALTERNATING If alternating, the Nitrogen present will be less than 4½ per cent. If continuous, the limited amount of Nitrogen present is neutralized by Carbon.

One gallon of Lima oil by our process EQUALS ALL THE COAL required for making 1,000 feet of carbureted Water Gas.

LACLEDE FIRE BRICK MANUFACTURING COMPANY,



ST. LOUIS, MO.

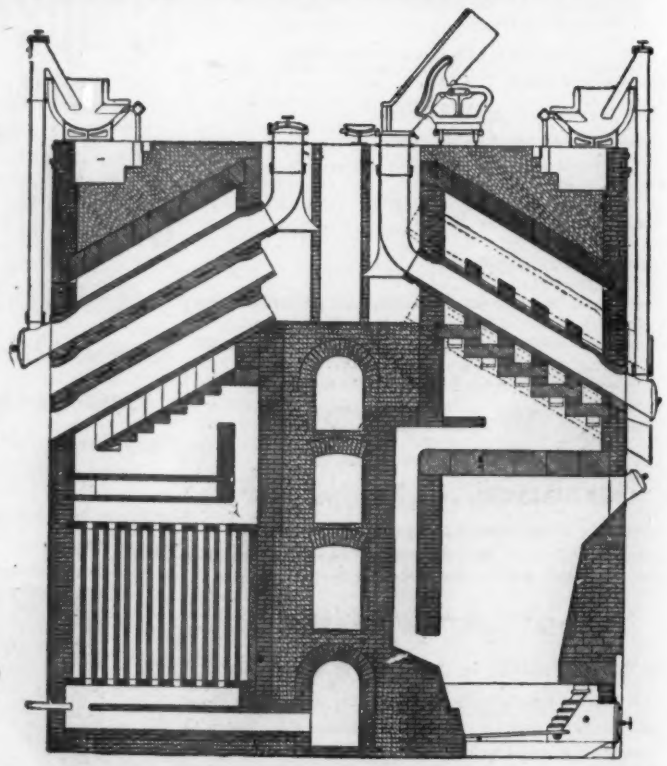
Exclusive Agents in the United States

FOR THE

Coze System of Inclined Retorts.

IT IS THE COMING BENCH FOR MAKING COAL GAS.

It will Save from 50 to 60 per ct. in Labor.



ESTIMATES AND PLANS FURNISHED BY THE

LACLEDE FIRE BRICK MFG. CO., ST. LOUIS, MO.

EDGEWATER LIME WORKS

Chas. F. McKenna, Proprietor.

SHELL LIME.

Lime by the Cargo for Gas Purification.

EDGEWATER, BERGEN CO., N. J.

Write for Testimonials and Prices.

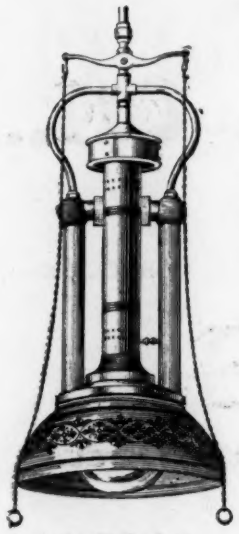
CHICAGO GAS STOVE CO.

MANUFACTURERS OF ALL KINDS OF

Gas Cooking and Heating APPLIANCES.

117-119 Lake St., CHICAGO.

Send for Catalogue.



Gordon Portico Lamp.

The Gordon Portico Lamp.

A successful Competitor of the Arc Electric Light for lighting Store Fronts, Show Windows, Depots, Railway Sheds, etc., etc.

The Gordon Street Lamp.

A Successful Competitor of the Arc Electric Light for lighting Streets, etc., etc.

Gordon Street Lamp.

The Lungren Lamp.

A Successful Competitor of the Incandescent Electric Light for Interiors, etc. Is especially applicable for the lighting of Offices, Stores, Factories, Mills, Show Windows, Libraries, and all situations where an increased illumination is desired.

More than 25,000 Lungren Lamps are now in use. Testimonials, references, or any desired information will be cheerfully given.

Lungren Lamp.

THE SIEMENS-LUNGREN CO., N.E. Cor. 21st St. & Washington Av., PHILADELPHIA.

WELSBACH SYSTEM

OF

Incandescent Gas Lighting.

OFFICE, DREXEL BUILDING, PHILA., PA.

At the Fall Session of the Board of Supervisors of Winnebago County, held at the County Court House, Oshkosh, Wis., Nov. 26, 1889, the report submitted by Mr. C. W. Cook, Chairman of the Committee on Public Buildings, recommending the use of the Welsbach Incandescent Gas Burner in the Buildings under their charge, was unanimously adopted, because of the extreme economy in the consumption of Gas and the superior character of the light obtained.

JEWEL GAS STOVES

MANUFACTURED BY

GEORGE M. CLARK & COMPANY,

Nos. 157 & 159 Superior Street, - - - Chicago, Ill.

EVERY CONCEIVABLE SIZE AND STYLE,

Ranging in Prices from $1.50 to $30.00.

WE USE NO GAS COCKS.

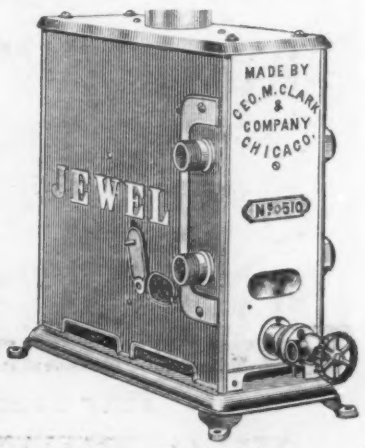
All Flames are Regulated by a Direct Needle Valve.

The JEWEL

IS THE

Only Well-Made Gas Stove on the Market.

Write for our 1890 Catalogue and see for yourself.



Jewel Circulating Water Heater.

NATIONAL GAS LIGHT AND FUEL CO.,

218 La Salle Street, Chicago.

C. D. HAUK, Prest. & Gen'l Manager. A. W. GREEN, Vice-Prest. N. A. McCLARY, Sec. & Treas. E. E. MORRELL, Engr.

GAS WORKS

Built, Remodeled, Leased, and Purchased.

71 Springer Cupolas have been installed in the U. S. during the past four years.

The total capacity of Springer Apparatus now in use is over 25,000,000 ft. daily.

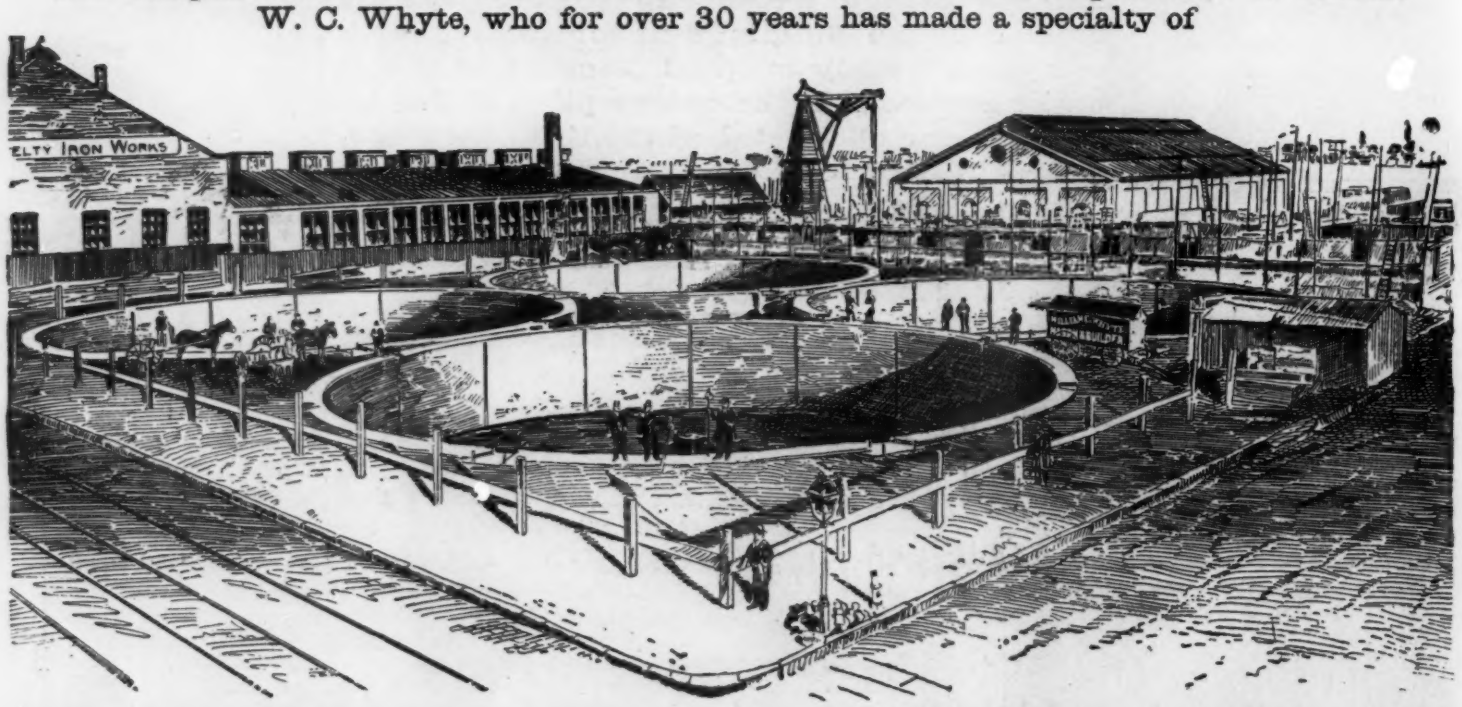
THE SPRINGER CUPOLA SYSTEM

Has Proven Itself the most Economical and Satisfactory Method of Gas Manufacture ever brought to the attention of the Gas Fraternity.

GUARANTEED ESTIMATES of Cost of Gas Furnished on Application.

GASHOLDER TANK CONSTRUCTION, ETC.

Gas Companies and others about to erect Gasholders will find it profitable to consult W. C. Whyte, who for over 30 years has made a specialty of



Tank Excavation and Mason Work.

Fifty Tanks now in operation show the sort of work done. Address

W. C. WHYTE. - No. 15 Cortlandt Street, N. Y. City

GAS STOVES. GAS METERS. GAS STOVES.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

MANUFACTURERS OF

Standard 3 Diaphragm Dry Meter.

Gas Meters,

STATION METERS,

METER PROVERS, PHOTOMETERS,

Pressure Gauges of all Kinds,

AND

Standard 2 Diaphragm Dry Meter.

Apparatus for Testing the Quantity and Quality of Gases.

GAS STOVES FOR HEATING AND COOKING.

Circulars and Price Lists on Application.

MANUFACTORIES,

508 to 514 West Twenty-second St., N. Y. Arch and Twenty-second St, Phila.

Nos. 244 & 246 North Wells Street, Chicago, Ill.

AGENCIES,

No. 177 Elm Street, Cincinnati, Ohio. No. 222 Sutter Street, San Francisco, Cal.

No. 810 North Second Street, St. Louis, Mo.

GAS STOVE SHOW ROOMS, No. 242 Sixth Avenue, New York Citv.

KIRKHAM, HULETT & CHANDLER, LIMITED.

PATENT "STANDARD" WASHER-SCRUBBERS

Erected and in course of construction at present date:

	Capacity. Cubic feet per day.
Altrincham	600,000
Adelaide	600,000
Aldershot	200,000
Allegheny, U. S. A.	1,000,000
Ashton-under-Lyne	1,250,000
Amsterdam	1,500,000
"	1,500,000
Annaberg	200,000
Arcachon	100,000
Animal Charcoal Co	200,000
Altoona, U.S.A.	350,000
Buxton	250,000
Bradford	1,000,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,000,000
"	1,000,000
"	3,000,000
Bremen	150,000
Baltimore, U.S.A.	1,000,000
"	1,900,000
"	1,000,000
Balmain, N.S.W	125,000
Bishops Stortford	150,000
Blackpool	400,000
Brussels	1,250,000
"	1,250,000
"	750,000
"	1,250,000
Banbury	250,000
Birmingham	5,000,000
Birkenhead	2,500,000
Blackburn	1,500,000
Bochum	600,000
Burntisland	250,000
Boston, U.S.A.	2,000,000
Brisbane	1,500,000
"	300,000
Burton-on-Trent	1,500,000
Barcelona	350,000
Barking	100,000
Baerlien & Co	20,000
"	20,000
Bombay	400,000
Buffalo, U.S.A., Mutual	750,000
" " Citizen	500,000
Brookline, U.S.A.	500,000
Bergen	350,000
Berlin	1,250,000
Bournemouth	1,000,000
Bridgeport, U.S.A.	500,000
Brunswick	300,000
Beck & Co., St. Louis	100,000
Barmen Rittershausen	600,000
Bexhill	125,000
Brooklyn, U.S.A	1,000,000
"	1,000,000
" Nassau	1,000,000
Brunner, Mond & Co.	400,000
Cheltenham	2,000,000
Cannes	200,000
Croydon	1,500,000
Copenhagen	200,000
Clevedon	200,000
Columbus, U.S.A.	500,000
Cincinnati, "	1,500,000
" "	1,500,000
Chicago "	3,000,000
" "	1,000,000
" "	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas Works Co	100,000
Cadiz	300,000
Charlottenburg	600,000
Dudley	750,000
Driffield	100,000
Dukenfield	500,000
Dover	750,000
"	1,000,000
Deal	200,000
Derby	1,500,000

	Capacity. Cubic feet per day.
Dublin	3,000,000
Dowlais	100,000
Douai	500,000
Denton	500,000
Derby, U.S.A.	350,000
Denver, "	500,000
" "	1,000,000
Dusselldorf	750,000
"	500,000
Dumfries	250,000
Dunedin, N.Z	400,000
Darlington	1,250,000
Detroit, U.S.A	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	300,000
Essen	300,000
Elbing	150,000
Falmouth	150,000
Frankfort	300,000
Farnworth	400,000
Fenton	400,000
Friedenshutte	500,000
Furth	400,000
Freiburg	200,000
Goole	250,000
Glossop	300,000
Guildford	300,000
Gloucester	1,250,000
Gera	300,000
Grafton, N.S.W	100,000
Grieg	300,000
Georgetown, U.S.A	250,000
Gluckauf	200,000
Heywood	600,000
Huy	70,000
Harrow	250,000
Harrogate	250,000
Halstead	150,000
Heilbronn	200,000
Havana, Cuba	750,000
Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
Heckmondwicke	500,000
Haverfordwest	100,000
Halifax, N.S.	350,000
Hamm	200,000
Halle	400,000
Heidelberg	300,000
Hartford, U.S.A	1,000,000
Ilkeston	300,000
Inverness	250,000
Ilkley	200,000
Ilford	100,000
Kingston-on-Hull	400,000
Kidderminster	750,000
Kidsgrove	100,000
Konigberg	1,000,000
King's Lynn	300,000

LONDON:—

The Gaslight and Coke Co.:	
Beckton	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	2,500,000
"	2,500,000
Silvertown	1,000,000
Bromley	2,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000

LONDON—*Continued.*	Capacity. Cubic feet per day.
Shoreditch	2,500,000
Pancras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms	3,000,000
"	3,000,000
South Metropolitan Co:—	
Greenwich	3,000,000
Woolwich	400,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	300,000
West Ham	1,500,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	2,000,000
Leominster	150,000
Leiden	560,000
"	600,000
Liverpool	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U. S. A	1,000,000
Louisville "	1,500,000
Long Eaton	500,000
Lilie	900,000
"	450,000
"	750,000
"	250,000
"	250,000
Luckenwalde	330,000
Liegwitz	300,000
Lincoln, U. S. A	250,000
Lawrence "	500,000
Lynn "	300,000
Lyons	1,500,000
Maidstone	1,000,000
Marseilles	1,500,000
"	1,500,000
Mons	500,000
Malines	250,000
Melbourne	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
Manchester	2,500,000
Middleton	400,000
Manley, N. S. W.	100,000
Minneapolis, U. S. A	750,000
Magdeburg	300,000
Memphis, U. S. A	750,000
Nottingham	1,250,000
"	2,500,000
"	2,500,000
"	2,000,000
"	1,500,000
"	2,000,000
Newport, U.S.A	430,000
Newmarket	150,000
Newark, U.S.A	680,000
Northfleet	200,000
New York, U.S.A	2,000,000
Nice	600,000
Newcastle, N. S. W.	200,000
Numea, "	100,000
Namur	250,000
Newark	350,000
Oldbury	500,000
Otley	200,000
Oswestry	250,000

	Capacity. Cubic feet per day.
Ober Schlesian	1,500,000
Otto & Co.'s Coke Works	1,500,000
Plymouth	2,000,000
Parramatta, N. S. W.	100,000
Prescott	150,000
Providence, U.S.A.	750,000
"	750,000
Plauen	300,000
"	300,000
Portsmouth	2,500,000
"	2,500,000
Pittsburgh, U.S.A.	1,500,000
Portland, "	560,000
Pawtucket, "	500,000
Quebec	250,000
Radcliffe	750,000
Rouen	250,000
Ramsgate	1,000,000
Reigate	200,000
Richmond, U.S.A	250,000
Roxbury, "	500,000
Runcorn Soap Co.	20,000
Rockhampton, N. S. W.	125,000
Richmond	1,500,000
Reading	2,000,000
Reichenbach	200,000
Salford	1,750,000
"	1,750,000
"	1,750,000
Smethwick	750,000
Sydney, N. S. W.	1,000,000
"	1,000,000
"	2,500,000
"	50,000
"	50,000
Sunderland	1,500,000
St. Josephs, U.S A	250,000
Spa	100,000
Sevenoaks	300,000
St. Petersburg	2,000,000
"	1,500,000
St. Louis, U.S.A	2,000,000
"	2,000,000
"	1,000,000
Laclede	1,000,000
Silesian Coal Co.	600,000
San Francisco, U.S.A	2,000,000
"	2,000,000
Sheepbridge Coal Co.	40,000
Stettin	200,000
Singapore	300,000
Sutton	500,000
Tonbridge	150,000
Tipton	400,000
Tottenham	1,000,000
Toledo, U.S.A	750,000
Toronto	1,000,000
Uxbridge	300 000
Valparaiso	500,000
West Bromwich	1,000,000
Willenhall	250,000
Weston super-Mare	500,000
Waltham	150,000
Wormwood Scrubs	300,000
Williamsburg, U.S.A	600,000
"	600,000
Wellington	150,000
Warwick	300,000
Wheeling, U.S.A	500,000
Walker	300,000
Westgate	100,000
Wilmington, U.S.A	500,000
Windsor, N. S. W.	100,000
Wolverton	100,000
Wellington, N. Z.	250,000
Whitchurch	175,000
Washington, U.S.A	2,000,000
Wallasey	750,000
Weimar	150,000
Wurzen	200,000
Worcester, U.S.A	750,000
Yeadon	500,000
Yeovil	250,000

SOLE AGENT FOR WESTERN HEMISPHERE,

GEO. SHEPARD PAGE, 69 WALL STREET, NEW YORK.

THE UNITED

GAS IMPROVEMENT CO.

Drexel Building,

CHESTNUT AND FIFTH STREETS,

PHILADELPHIA, PA.

OFFICERS:

WILLIAM W. GIBBS, President.
GEORGE PHILLER, Vice-President.
SAM'L T. BODINE, Gen'l Manager.
RANDAL MORGAN, Gen'l Counsel.

EDWARD C. LEE, Sec'y and Treas.
ALEX. C. HUMPHREYS, Gen'l Supt.
WALTON CLARK, Ass't Gen'l Supt.
H. H. EDGERTON, Chem. and Eng'r.

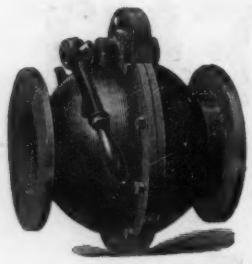
DIRECTORS:

GEORGE PHILLER,
THOMAS DOLAN,
HENRY C. GIBSON,
WM. T. CARTER,
WILLIAM G. WARDEN,
SAM'L T. BODINE.

BUILDERS, LESSEES AND PURCHASERS OF

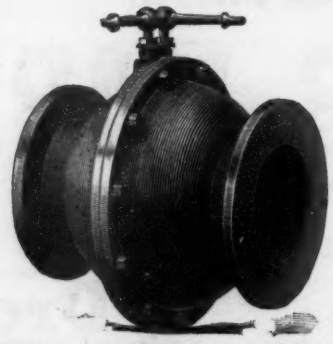
GAS WORKS.

ROOTS'
GAS AND BYE-PASS VALVES.



GAS VALVE

Quick Acting,
Simple,
Efficient, Durable.

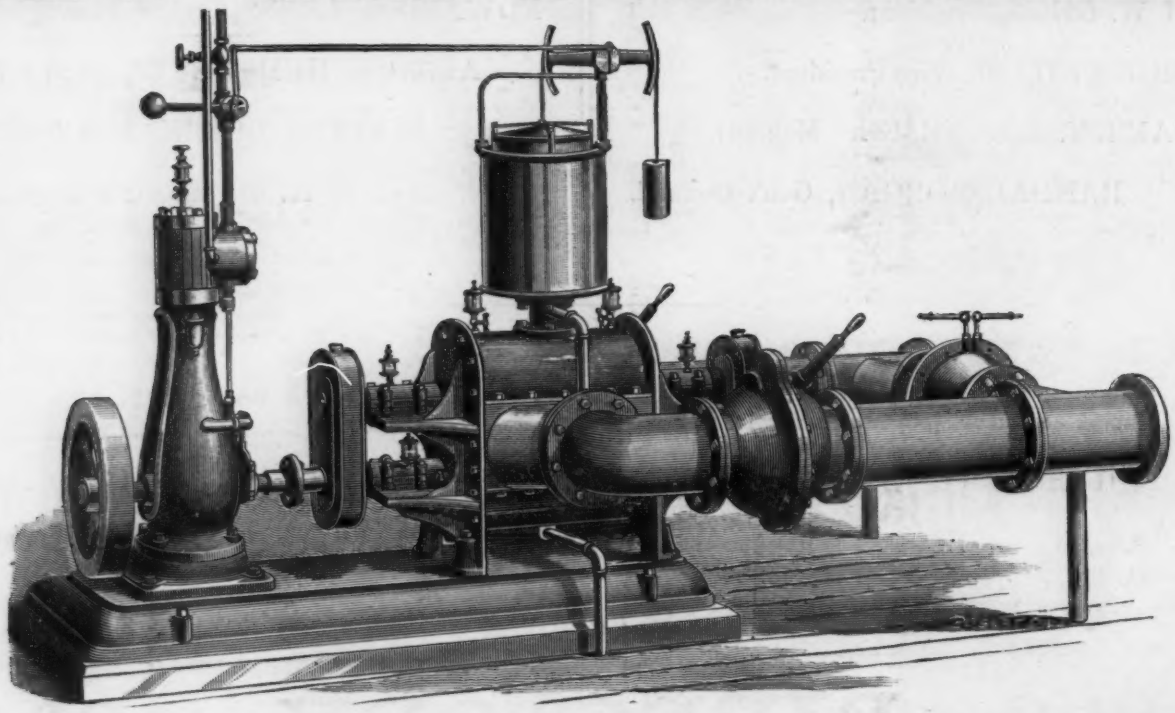


BYE-PASS VALVE.

Automatic Action
Reliable
Simple Durable.

Thousands now in use and giving perfect satisfaction. Write for Catalogue and Prices.

ROOTS'
NEW GAS EXHAUSTER.



We will take pleasure in furnishing estimates on complete plants, including **GAS EXHAUSTER, ENGINE, and GAS GOVERNOR,** all connected, complete, on same bedplate. Also, estimates for **GAS VALVES, BYE-PASS VALVES, and PIPE FITTINGS,** arranged in any manner to suit the exhauster room or main connections.

All flanges of pipe and valve fittings faced off, with bolt holes drilled, all ready to go together.

S. S. TOWNSEND, General Agent,
COOKE & CO., Selling Agents,
} 22 Cortlandt St., N. Y.

P. H. & F. M. ROOTS CO., Connersville, Ind.

CONNELLY & CO.,

SOLE MANUFACTURERS OF THEIR PATENTED SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying agent ever offered as a substitute for lime. Now used *in every State in the Union*, and purifying daily over *thirty-five million cubic feet.* Should be used in every gas works. Its own saving will pay for it many times over.

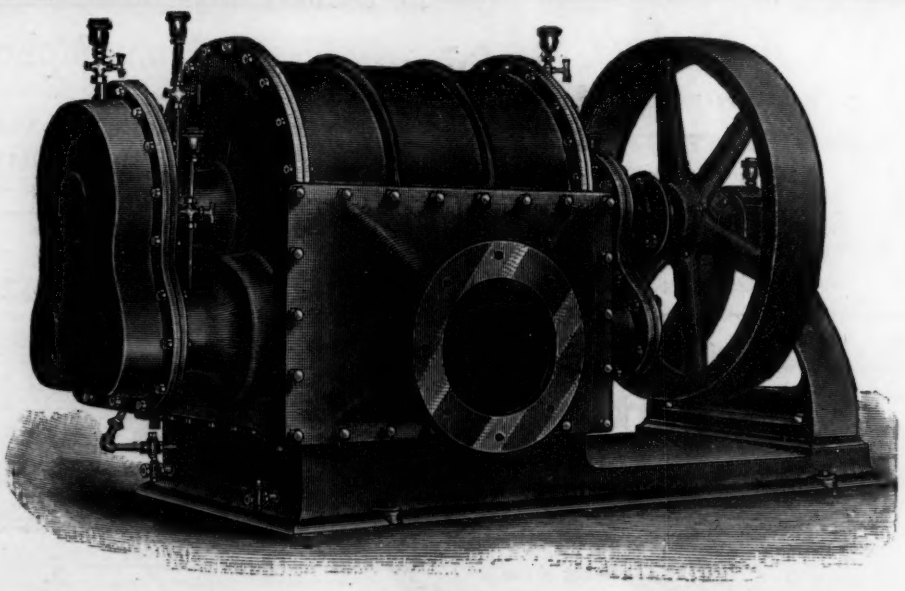
AUTOMATIC GOVERNOR. Has been on the market but *three years*, and in that time has been introduced *more generally* than any invention ever designed for use in gas works. Over *two hundred* of them now in use. Sensitive; reliable; perfectly automatic; reduces leakage; satisfies consumers, and gives great relief to the Manager. No gas works is *complete* without one of these machines.

STEAM JET EXHAUSTER. Designed particularly for small works Combines Exhaust Tube, Steam Governor Gas Compensator, and Bye-Pass Valves in the most compact form possible; occupies but little space; uses very little steam; operated by ordinary workmen; saves formation of carbon in retorts; increases yield 10 to 15 per cent. Specially adapted for *mixing air* with oil gas. *No works* too small to use them profitably.

Prices given on all our specialties *delivered at any point in the United States.* Correspondence solicited.

CONNELLY & CO., No. 111 Broadway, New York City.

WILBRAHAM GAS EXHAUSTER



WILBRAHAM BROS.,

PHILADELPHIA, PA.

JARVIS ENGINEERING CO.,

61 Oliver St., Boston, Mass.

CONTRACTORS FOR ERECTING

COMPLETE STEAM OUTFITS FOR ELECTRIC LIGHTING STATIONS.

Steel Boilers set with Jarvis Pat. Boiler Setting

To burn **COKE SCREENINGS** for Fuel.

ARMINGTON & SIMS CO. ENGINES,

Belting direct to Dynamos, without using Shafting.

SEND FOR CIRCULARS.

REFERENCES.—Charlestown Gas & Electric Light Co., Charlestown, Mass.; Schenectady Gas & Electric Light Co., Schenectady N. Y.; Brookline Gas Co., Brookline, Mass.

Practical Electric Lighting

By A. BROMLEY HOLMES, A.M.I.C.E.

With 87 Illustrations. Third Edition. **Price, $1.00.**

Electric Light Primer.

By CHARLES L. LEVEY.

A simple and comprehensive Digest of all the most importan facts connected with the running of the Dynamo and Electr Lights, with Precautions for Safety, etc.

Price, 50 cents.

A. M. CALLENDER & CO., 42 Pine St., N.Y.

Gasholder Tanks & Gas Works Masonry Complete.

PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.

J. P. WHITTIER, - - 499 Wythe Av., Brooklyn, N. Y.

1890 DIRECTORY 1890

OF THE GAS LIGHT COMPANIES of the UNITED STATES & CANADA

Price, - - - - - - - $5.00.

A. M. CALLENDER & CO., No. 42 Pine Street, N. Y. City.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants With and Without Independent Nozzle Valve. All Work Guaranteed.

WORKS & GEN'L OFFICE: Indian Orchard, Mass.

TREASURER'S OFFICE: 72 Kilby & 112 Milk Sts, Boston, Mass.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR UTILIZING COAL TAR AS FUEL.

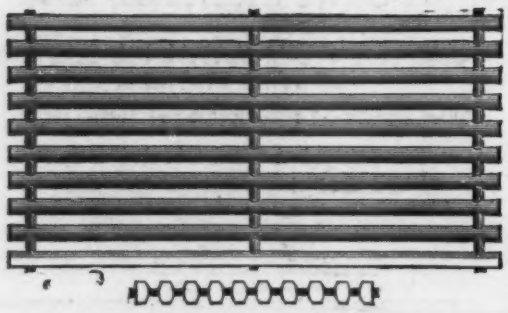
PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial.* No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., 33 & 35 Liberty St., N.Y

MILLS' REVERSIBLE LIME TRAY,



AND

WOODWORK

Of Every Description

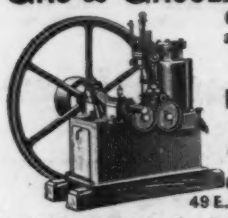
NEEDED BY GAS WORKS.

SEND FOR CIRCULAR AND PRICE LIST TO

BARTLETT, HAYWARD & CO.,

Pratt and Scott Streets, Baltimore, Md.

VAN DUZEN GAS & GASOLINE ENGINE



OPERATED with COAL and OTHER MANUFACTURED GASES AND GASOLINE.

RELIABLE AND ECONOMICAL.

Fully Warranted

VAN DUZEN Gas & Gasoline Engine Co. 49 E. 2d St., Cincinnati, O.

A. MacKinnon Machine Co., Agts., 22 Warren St., N.Y.

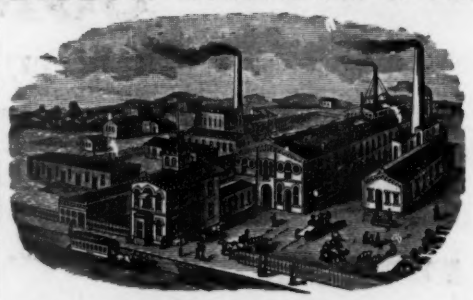
The Management of Small Gas Works.

BY C. J. R. HUMPHREYS.

Price, $1.

Orders to be sent to **A. M. CALLENDER & CO.,** 42 PINE STREET, NEW YORK.

LUDLOW VALVE MFG. CO.

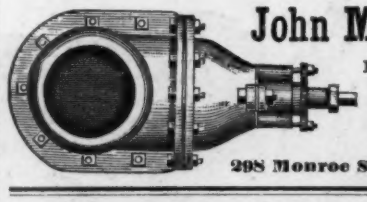


OFFICE AND WORKS,

938 to 954 River Street and 67 to 83 Vail Av., TROY, N. Y.

Hydraulic Main Dip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants. Send for Circulars.

Valves.—Double and Single Gate, ¾ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil. Send for Circulars.



John McLean

Man'facturer

GAS VALVES.

298 Monroe Street, N. Y.

SPECIAL TRAYS FOR IRON SPONGE OR OXIDE OF IRON.

CHURCH'S TRAYS A SPECIALTY.

REVERSIBLE-STRONGEST-MOST DURABLE-MOST EASILY REPAIRED.

306-310 ELEVENTH AVENUE, NEW YORK.

WE ALSO MAKE THE CHEAPEST AND STRONGEST REVERSIBLE BOLTED TRAYS IN THE MARKET.

THE CLERK GAS ENGINE CO.,

Main Office, 1012, 1014, 1016, 1018 Filbert St., Philadelphia, Pa.

WM. W. GOODWIN, Prest. E. STEIN, Sec. S. LEWIS JONES, Asst. Sec. A. J. DOTY, Supt.

The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York, in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time!

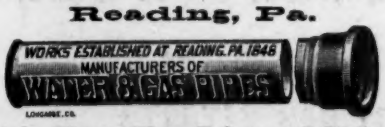
Made in Sizes of 5. 10. 15' 20. and 25 Horse Power. All Engines Guaranteed for One Year.

ENGINEERS.

P. D. WANNER, Chairman. A. H. MELLERT, Mangr. of Wks.
R. B. KINSEY, Secretary. F. A. KNOPP, Treasurer.

MELLERT FOUNDRY & MACHINE CO. Ltd. and READING FOUNDRY CO., Ltd.

Reading, Pa.



Specials—Flange Pipe, Valves and Hydrants Lamp Posts, Retorts, etc.

General Foundry and Machine Work.

JOHN FOX, Selling Agent. **160 Broadway, N.Y.**

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.

Office, Corbin Building, 192 Broadway, N. Y.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS
FOR WATER AND GAS.

JOS. R. THOMAS,

No. 42 Pine Street, N.Y. City.

CONSULTING AND CONSTRUCTING

Gas Engineer and Contractor.

PLANS, SPECIFICATIONS, AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works,

Either for New Works or Extensions to Old Plants.

WM. MOONEY

(Successor to WM. FARMER)

No. 94 Liberty St., N Y. City.

GAS ENGINEER AND CONTRACTOR FOR THE ERECTION OF GAS WORKS, OR APPARATUS OF ANY CAPACITY.

Plans and Specifications Furnished.

WM. GARDNER,

Gas Engineer,

Lewis Block, Room 20, Pittsburgh, Pa.

Those who intend to make alterations in existing gas plants, or who contemplate the erection of new works, will find it to their interest to open correspondence with the above. Plans made and estimates furnished.

GAS AND WATER PIPES.

SAM'L R. SHIPLEY, Pres. JAS. P. MICHELLON, Sec.
HENRY B. CHEW, Tre WM. SEXTON, Supt.

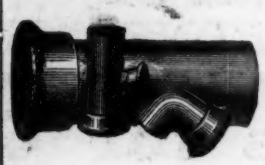
GLOUCESTER IRON WORKS,

GLOUCESTER CITY, N. J.

Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gasholders. &c.

Office, Rooms 61 and 63 Bullitt Building, 131 S. 4th St., Phila., Pa.

WARREN FOUNDRY AND MACHINE CO.,



Established 1856. **Works at Phillipsburgh, N. J.**

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM TWO TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

DENNIS LONG & COMPANY,

LOUISVILLE, KY.,

Manufacture Exclusively

CAST IRON GAS & WATER PIPE & SPECIAL CASTINGS

OF ALL SIZES.

King's Treatise on Coal Gas.

A stan ard text-book for the Engineers and Managers of Gas Works, and for all who are concerned or take an interest in the manufacture and distribution of Coal Gas, and in the utilization of the Secondary Products resulting therefrom; treating also of the Gas Engine, and of Gas Cooking and Heating Appliances.

In 3 Vols. Price per Vol., $10. Sold either by Volume or in Sets.

A. M. CALLLENDER & CO., 42 Pine St.. N. Y.

RETORTS AND FIRE BRICK.

J. H. GAUTIER & CO.,

CORNER OF

GREENE AND ESSEX STREETS,

JERSEY CITY, N. J.

MANUFACTURERS OF

Clay Gas Retorts,

Gas House Tiles,

Fire Bricks, Etc. Etc.

Ground Clay, Fire Brick and Fire Sand in Barrels,

J. H. GAUTIER. C. E. GREGORY. C. E. GAUTIER.

BROOKLYN

Clay Retort & Fire Brick Works,

(EDWARD D. WHITE & CO.)

Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.

VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.

Office, 88 Van Dyke St., Brooklyn, N. Y.

RETORTS AND FIRE BRICK.

LACLEDE FIRE BRICK MFG. CO.,

MANUFACTURERS OF

Fire Brick, Gas Retorts,

AND

ST. LOUIS STANDARD SEWER PIPE.

Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.

OFFICE AND DEPOT

901, 903, and 905 Pine Street, ST. LOUIS, MO.

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

OFFICE FOOT OF HOUSTON ST., E.R., N.Y.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

RETORTS AND FIRE BRICK.

MANHATTAN

FIRE BRICK & ENAMELLED CLAY

RETORT WORKS

ADAM WEBER.

CLAY GAS RETORTS AND RETORT SETTINGS

FIRE BRICKS, TILES, ETC.,

Office and Works, 15th Street and Avenue C., N. Y.

Works, LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Office, Rooms 19 & 20, Lewis Block, PITTSBURGH, PA. P. O. Box 373.

Successor to WILLIAM GARDNER & SON.

Fire Clay Goods for Gas Works.

H. A. NORTON, No. 4 CENTRAL STREET, BOSTON, MASS., Agent for the New England States.

GEO. C. HICKS, Prest. **CHICAGO** CHAS. A. REED, Sec. & Treas.

Retort and Fire Brick Co.,

MANUFACTURERS OF

Fire Clay Goods of all Kinds,

AND BEST QUALITY ONLY.

Regenerative Furnaces & Water Gas Goods.

45th St., Clark to La Salle, Chicago.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement for patching retorts, putting on mouthpieces, and making up all bench-work joints. This Cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick. For recommendations and price list address

C. L. GEROULD & CO.,

5 & 7 Skillman St., Brooklyn, N. Y.

Western Agent, H. T. GEROULD, Mendota, Ill.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,

Mermod-Jaccard Bldg., Rooms 307 & 308, Broadway & Locust St., St. Louis. Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We have the *exclusive Agency for the West* of the celebrated

Kloenne-Bredel Full Depth and Semi-Recuperator Benches,

And also furnish and build

Our Own Styles Semi-Recuperator Furnaces for the use of Coal or Coke as fuel.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt.

BALTIMORE

RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 88 WATER ST., BOSTON, MASS

Sole Agents the New England States.

Boston Fire Brick Works Manufacturers of **Gas Retorts and Settings**

Under the Personal Supervision of MR. GEO. C. HICKS late of Chicago.

Fire Clay Goods of all kinds. Akron Sewer Pipe, Lime, Cement, etc. Agts. for the Arc Gas Lamp & Governing Gas Burners.

Send for Circulars and Prices to

FISKE, COLEMAN & CO., Managers, No. 62 Congress Street, Boston, Mass.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.

OFFICE, 418 to 422 East 23d St., N. Y.

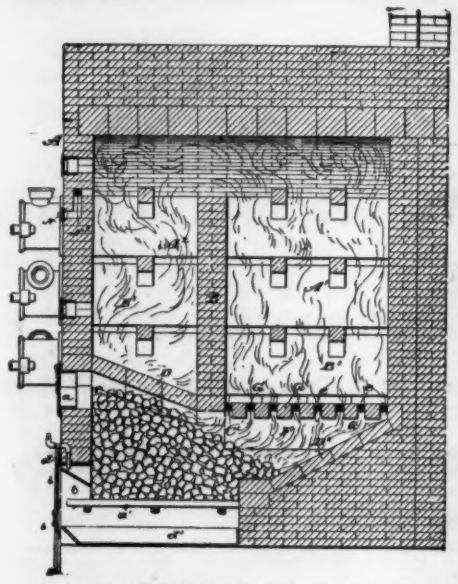
Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J.

Address as above, or D. D. FLEMMING, Jersey City, N. J.

FRED. BREDEL,

CONTRACTOR FOR THE COMPLETE

Erection and Equipment of Gas Works.

SOLE PROPRIETOR OF THE

KLOENNE PATENTS

FOR NORTH AMERICA.

REGENERATIVE FURNACES.

(900 Retorts are now fired in America by the Kloenne-Bredel System.)

SELF-SEALING MOUTHPIECES.

(Over 800 Now in Use.)

Standard Condensers. Washer-Scrubbers.

TAR WASHERS FOR WATER GAS PLANTS.

(In use in the works of the Chicago Gas Lt. Co.)

GASHOLDERS.

Bredel's Automatic Gas Governor.

Refers, by permission, to Mr. Eugene Vanderpool, Newark, N. J.; Mr E. G. Cowdery, Milwaukee, Wis.; and Mr. Theo. Forstall, Chicago, Ills. For further infomation, address

FRED. BREDEL,

No. 208 East Seventeenth Street, N. Y. City.

SCIENTIFIC BOOKS.

KING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols.; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $2.80.

GAS CONSUMER'S GUIDE. $1.

A GUIDE TO GAS LIGHTING. 40 cents.

GAS MEASUREMENT AND GAS METER TESTING, by F. W. HARTLEY. $1.60

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

A PRACTICAL TREATISE ON GAS AND VENTILATION with Special Relation to Illuminating, Heating, and Cooking Gas, by E. E. PERKINS. $1.25.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $8.

COAL; ITS HISTORY AND USE. by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

THE GAS FITTER'S GUIDE, Showing the Principles and Practice of Lighting with Coal Gas, by JOHN ELDREDGE. 40 cents.

GAS WORKS, AND MANUFACTURING COAL GAS, HUGHES. $2.20.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. BUMPHREYS. $1.

MANUAL FOR GAS ENGINEERING STUDENTS, by D. LEE, 40 cents.

HOW TO MANAGE GAS, by F. WILKINS. Paper. 20 cents.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DIGEST OF GAS LAW. $5.

DISTLLATION OF COAL TAR AND AMMONIACAL LIQUOR. by GEO. LUNGE. New Edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM 8vo., Cloth. $3.

GAS COMPANIES DIRECTORY. $3.

GAS VERSUS ELECTRIC LIGHT. 50 cents.

THE AMERICAN GAS ENGINEER AND SUPERINTENDENT'S HANDBOOK, by WM. MOONEY. $3.

GAS ENGINE INDICATOR DIAGRAM, by W. E. AYRTON. Paper. 20 cents.

ILLUMINATING AND HEATING GAS, by W. BURNS. $1.50.

TESTING PIPES AND PIPE JOINTS, by M. M. PATERSON. 80 cents.

DESIGNING WROUGHT AND CAST IRON WORK, by H ADAMS. Paper. Three parts, 60 cents each.

NOTES IN MECHANICAL ENGINEERING, by H. ADAMS. $1.

STRAINS IN IRONWORK, by H. ADAMS. With plates. $1.75

The above will be forwarded by express, upon receipt of price. If sent by mail, postage must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

A. M. CALLENDER & CO., 42 Pine Street, New York.

Newbigging's Handbook for Gas Engineers and Managers.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text, and much of it has been re-written and otherwise improved. It extends to 524 pages, and contains 193 illustrations. **Price, Cloth, $6.00.**

A. M. CALLENDER & CO., - - - - No. 42 Pine Street, N. Y. City.

DAVIS & FARNUM MFG. CO.,

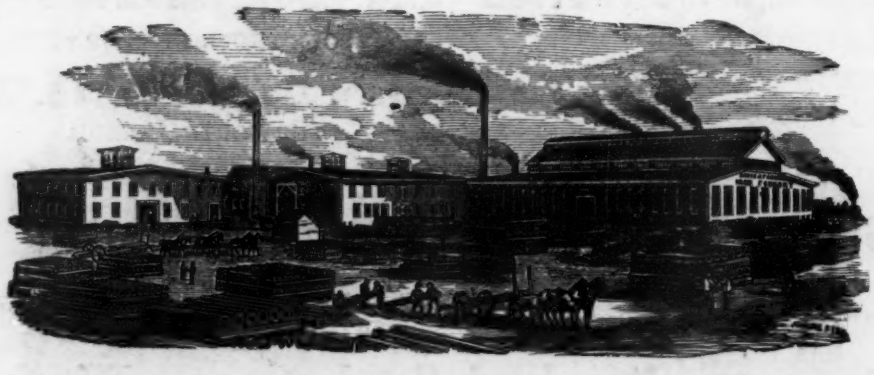
WALTHAM, MASS.

PRINCIPAL OFFICE AND WORKS, Waltham, Mass. BOSTON OFFICE, Room 55, Mason Building, 70 Kilby Street.

SINGLE, DOUBLE, AND TRIPLE LIFT

Gasholders.

OF ANY CAPACITY.



TUBULAR, PIPE, AND SINUOUS FRICTION

Condensers.

OF ALL SIZES.

IRON ROOF FRAMES AND FLOORS.

Purifying Boxes, Center Seal or Valve Connections, Bench Work.

Reversible Lime Trays.

SELF-SEALING AND PRESSED STEEL MOUTHPIECE LIDS.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Plant.

—ALSO—

Gas and Water Pipe, Flanged Pipe,

Sugar House Work, and Special Castings of all Descriptions.

Established 1861. Incorporated 1881.

KERR MURRAY MFG. CO.,

FORT WAYNE, IND.

Those who are in need of

Holders or Gas Works Apparatus of any Description,

AND OF THE LATEST IMPROVEMENTS,

will find it to their interest to

GET AN ESTIMATE FROM US

before placing their order.

As we make a Specialty of this Class of Work, and are Practical Builders and Manufacturers of same,

with our long years of experience in the business,

WE CAN GUARANTEE YOU SATISFACTION.

Estimates, Plans and Specifications Furnished on Application.

BARTLETT, HAYWARD & CO.

Baltimore, Md.

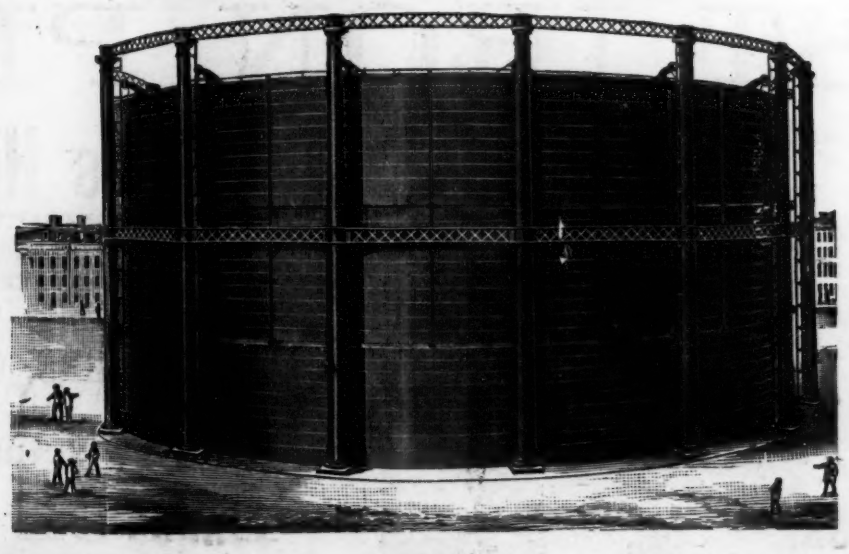
Triple Double, & Single-Lift
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS.



PURIFIERS.

CONDENSERS.

Scrubbers.

BENCH CASTINGS.

OIL STORAGE TANKS.

Boilers.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

Munich Regenerative Furnace, System Drs. Schilling & Bunte.

HAZELTON BOILERS.

Gas Works Designed and Constructed.

Pascal Iron Works. ESTABLISHED —1821.— Delaware Iron Works.

MORRIS, TASKER & CO.,

INCORPORATED.

OFFICE, 224 SOUTH THIRD STREET, - - PHILADELPHIA, PA.

CONTRACTORS, BUILDERS, AND MANUFACTURERS OF

Gas, Water & Sugar Works

Bench Castings.

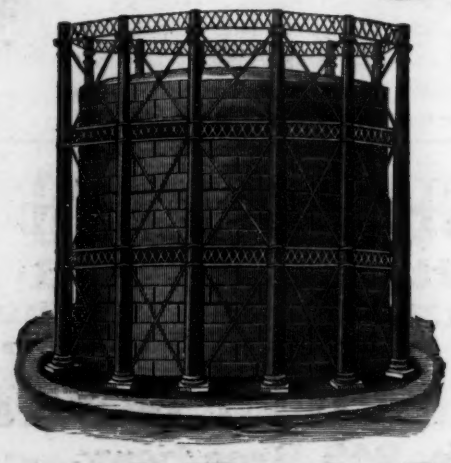
Condensers.

Scrubbers.

Purifiers.

Hyd. Carriages.

Iron Floors,



Iron Roofs.

Street Stops,

Valves, etc.

Stand-Pipes.

Water & Oil

Tanks, all Sizes.

Single, Double, and Triple-Lift Gas Holders.

SELF-SEALING RETORT LIDS. STAMPED STEEL RETORT LIDS.

Locomotive Water Columns, Filters, etc. Boiler Tubes, Wrought Iron Pipe & Fittings

Plans, Specifications and Estimates for all kinds of Machinery furnished on application.

Foundries & Works, MILLVILLE, FLORENCE, and CAMDEN, N. J.

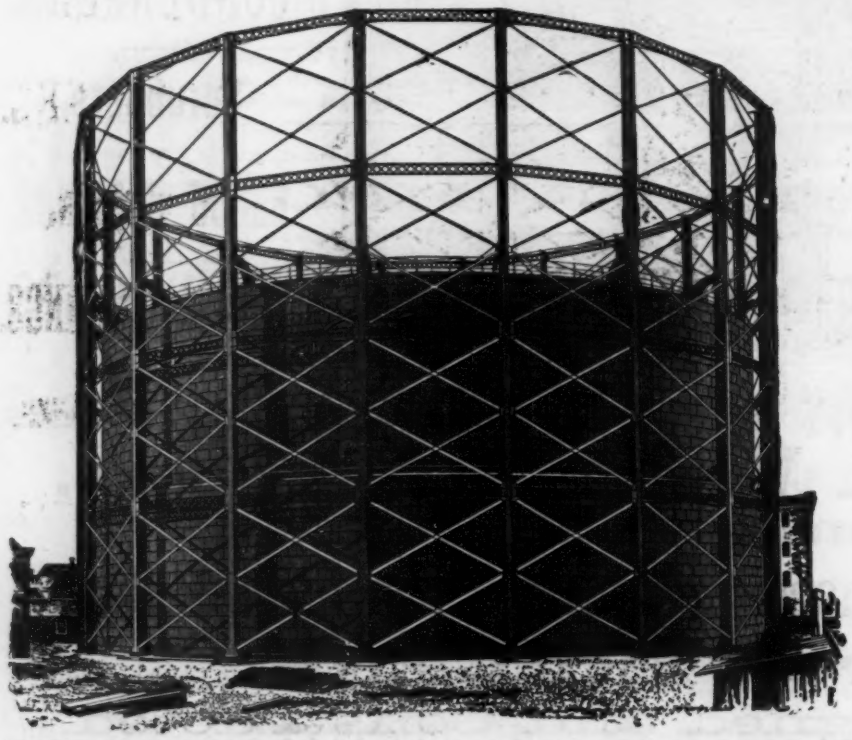
R. D. WOOD & CO.,

Engineers, Iron Founders, and Machinists.

400 Chestnut St., PHILADELPHIA, PA.

MANUFACTURERS OF

CAST IRON PIPE,



Gas Holders,

SINGLE, DOUBLE, AND TRIPLE LIFTS, WITH OR WITHOUT WROUGHT IRON OR STEEL TANKS.

PURIFIERS, CONDENSERS.

Scrubbers.

BENCH WORK.

Iron Floors and Roofs, Plate Girders.

Heavy Loam Castings.

HYDRAULIC WORK.

Lamp Posts, Valves, Etc.

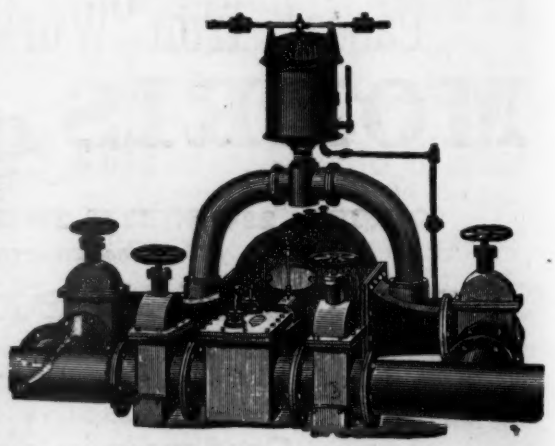
SMITH & SAYRE MFG. COMPANY,

G. G. PORTER, Prest. *245 Broadway, N. Y.* CHAS. W. ISBELL, Sec'y.

Machinery & Apparatus for Gas Works

Drawings, Plans, and Estimates Furnished for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

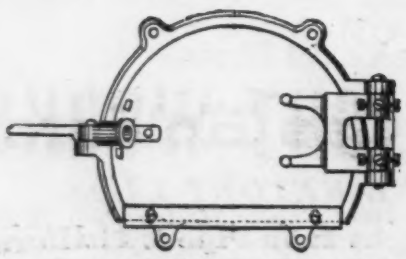
Mackenzie's Patent Rotary and Steam Jet Gas Exhausters, Governors, Compensators, Condensers, Washers, Scrubbers. Isbell's Patent Automatic Street Pressure Governor, Gas and Water Valves, Hydraulic Main Dip Regulator, Bench Castings, etc. Purifying Boxes and "Standard" Scrubbers. Isbell's Patent Self-Sealing Retort Doors



THE BRENNER SELF-SEALING RETORT DOOR.

Simple, Strong, and Durable.

CLOSES ABSOLUTELY TIGHT & IS LOCKED BY A CAM LEVER. ALL NECESSARY ADJUSTMENT FOR WEAR PROVIDED.



Brenner Self-Sealing Retort Door.

BUILT BY

SMITH & SAYRE MFG. CO.,

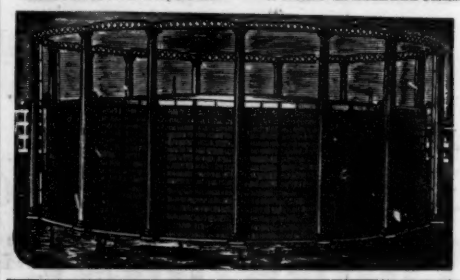
No. 245 Broadway, - - - - New York City.

WILLIAM B. LUNDIE, Superintendent of the 42d Street Station of the Consolidated Gas Company, of New York, writes, under date of Jan. 4, 1889:

"We have 320 Brenner Self-Sealing Lids in use at this Station, built by the Smith & Sayre Mfg. Co. They require very little attention, and are the best of the kind that I have seen, giving entire satisfaction."

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD & SONS,
(SUCCESSORS TO HERRING & FLOYD)
Oregon Iron Works,
W. 20th & 21st. Sts., bet. 10th & 11th Avs.,
NEW YORK CITY.
Engineers and Contractors
FOR THE
CONSTRUCTION OF GAS WORKS.
MANUFACTURERS OF
All Kinds of Castings and General Ironwork
FOR
GAS APPARATUS.
Bench Castings, Regenerative and Half Regenerative Furnace Castings.
Condensers, Scrubbers, Purifiers, Street Drips and Connections,
Valves,
Hydraulic Hoisting Purifier Carriage, Self-Sealing Retort Lids, Improved Valve Stand and Indicator, Seller's Cement.
Plans, Specifications, and Estimates furnished for Construction of New or Alteration of Old Works.

CONTINENTAL IRON WORKS.
THOS. F. ROWLAND, Prest. WARREN E. HILL and CHAS. H. CORBETT, V-Prests. THOS. F. ROWLAND, JR., Sec. & Tr

P. O. Station G., BROOKLYN, N. Y.
ENGINEERS AND MANUFACTURERS OF
Gas Holders
CONDENSERS, SCRUBBERS, VALVES,
PURIFIERS, SELF-SEALING RETORT LIDS
Hydraulic Mains,
And all other articles connected with the manufacture and distribution of Gas.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.
STACEY MFG. CO.,
MANUFACTURERS OF
Single and Telescopic Gasholders,
IRON ROOFS, BRIDGES, LAMP POSTS,
Water and Oil Tanks, Coal Elevator Cars,
COKE CRUSHERS, BENCH CASTINGS,
And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works Rolling Mill Machinery and Heavy Castings a Specialty.
Foundry: 33, 35, 37 & 39 Mill Street.
Wrought Iron Works: 16, 18, 20, 22, 24 & 26 Ramsey Street.
Cincinnati, Ohio.

Bouton Foundry Co.,
FOUNDERS AND MACHINISTS,
CHICAGO, ILL.
Gas Works Apparatus,
PURIFIERS, CONDENSERS,
Bench Work
SPECIALS, LAMP POSTS,
SCRUBBERS,
Iron Roofs and Floors.
Plans and Estimates furnished for new works or extensions of old works.

1842. DEILY & FOWLER, 1890.
Laurel Iron Works.
Address, No. 39 Laurel Street, Philadelphia, Pa.
BUILDERS OF
GASHOLDERS,
Single and Telescopic.
Holders Built 1884 to 1888, Inclusive:

Newport, R. I.	Long Island City, N. Y.	Port Chester, N. Y.	Malden, Mass.	West Chester, Pa. (2d
Portland, Oregon.	Macon, Ga.	New Rochelle, N. Y.	Paducah, Ky.	Lancaster, Pa. (3d)
Allegheny, Pa. (2d.)	York, Pa.	Salem, N. J (3d)	Norwich, Coon.	Tacony, Pa. (two)
Atlanta, Ga. (3d.)	Chester, Pa.	Omaha, Neb. (2d)	Seattle, W. T.	Mount Vernon, N. Y.
N.Y.City (Central Gas Co)	Hazleton, Pa. (2d.)	Lynn, Mass. (2d)	San Diego, Cal.	Binghamton, N. Y.
Lynchburg, Va. (2d.)	Staten Island, N. Y.	Little Rock, Ark.	Northern Gas Lt. Co., of	Concord, N. H.
Saylesville, R. I.	Saugerties, N. Y.	Irvington, N. Y.	New York, N. Y.	Dover, Del. (2d)
Rondout, N. Y.	Clinton, Mass. (Lan. Mills)	South Boston, Mass.	Westerly, R. I.	Calais, Me.
Atlantic City, N. J.	Chattanooga, Tenn.	Rye, N. Y. (2)	Willimantic, Conn	New London, Conn. (3d)
Augusta, Ga.	Galveston, Texas. (3d.)	Woodstock, Ont.	Montclair, N. J.	West Chester, N. Y.
Waltham, Mass. (2)	Omaha, Neb.	Malden, Mass.	Attleboro, Mass.	Bay Shore, L. I.
Mahanoy City, Pa.	Fort Plain, N. Y.	Staten Island, N. Y. (2d)	Santa Cruz, Cal.	Washington, D. C.
New Castle, Pa.	Brunswick, Ga.	Woodstock, Ont.	Erie, Pa. (2d)	

WM. HENRY WHITE,
No. 32 Pine Street, - - - New York City.
ENGINEER AND CONTRACTOR FOR THE
ERECTION AND EXTENSION OF
GAS, WATER, AND ELECTRIC LIGHT WORKS.
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.

GAS COALS. CANNEL COALS. GAS ENRICHERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York.

Cable Address, "PERKINS, NEW YORK." Post Office Box 3695, New York.

GENERAL SALES AGENTS FOR

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

HON. W. L. SCOTT, Prest. M. H. TAYLOR, Vice-Prest.

This Colliery is located at SCOTT HAVEN, PA., in the center of the Youghiogheny Gas Coal District, and produces the ONLY RELIABLE YOUGHIOGHENY COAL for gas purposes. (See Map on p. 87 of this JOURNAL, Feb. 16, '85.)

POINTS OF SHIPMENT,

Locust Point, BALTIMORE. Pier No. 62, PHILADELPHIA.

Also, SOLE AGENTS for the

BRECKENRIDGE CANNEL,

OF KENTUCKY.

Within the past two years we have delivered this Cannel to over ONE HUNDRED COMPANIES IN THIRTY-THREE DIFFERENT STATES, and it is now in use in some of the large Gas Works

On the Continent and in South America,

where it successfully competes with the Australian Shale. It is the ONLY AMERICAN GAS CANNEL of sufficiently high grade to warrant EXPORTATION TO EUROPE AND SOUTH AMERICA, and it is the only economical substitute for OIL OR NAPHTHA. ONE GROSS TON will produce

10,000 Cubic Feet of 75 Candle Gas,
or 12,500 " " 60 " "
or 15,000 " " 50 " "
} equal to { 750,000 Candle Feet of Gas, and 26 Bushels of merchantable Coke weighing 900 Pounds

This is the ONLY GAS CANNEL that will produce a REALLY MERCHANTABLE COKE. It can be delivered in parcels of one carload or more to any point in the United States or Canada. Cargo shipments of any size required can be made from NEW YORK, PHILADELPHIA, BALTIMORE, or NEWPORT NEWS. Samples will be sent and particulars of price, etc., forwarded upon application to above address.

JAMES & WILLIAM WOOD,

Gas and Cannel Coal Contractors,

No. 40 St. Enoch Sq., Glasgow. No. 2 Talbot Court, London.

Proprietors of the BATHVILLE COLLIERIES (which produce the celebrated BOGHEAD CANNEL), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

Also, WEST FAIRMONT GAS COAL, of W. Va.

Analyses, prices, and all further information furnished on application to

Agency for U.S., Room 70 Nos. 2 & 4 Stone St., N.Y. City.

The Standard Oil Company,

REFINERS OF

NAPTHA AND GASOLINES.

ALSO MANUFACTURERS OF

A Special Grade of Naptha for Gas Companies

FOR ENRICHING COAL GAS.

Correspondence solicited.

No. 43 Euclid Avenue, Cleveland, Ohio.

To Gas Companies.

We make to order CAP BURNERS to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

948 N 8th Street, Phila., Pa.

COKE CRUSHERS. GAS COALS. GAS COALS.

Newburgh Orrel Coal and Coke Co.

MINERS AND SHIPPERS OF

STEAM, SMITHING, AND GAS COALS,

Foundry and Crushed Coke.

Home Office, 33 S. Gay Street, Baltimore, Md.

J. HARRY LEE, President.

Shipping Wharves, Locust Point, Baltimore.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

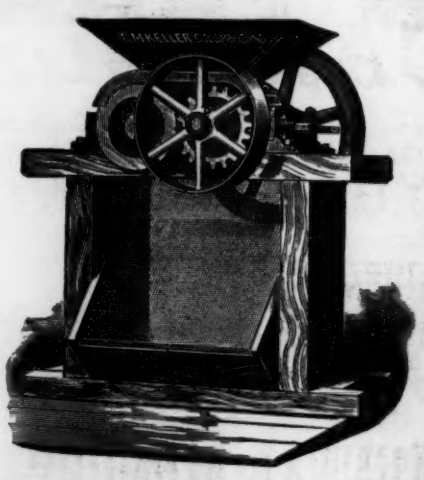
DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, Clarksburg, Harrison Co., W. Va.
WHARVES, Locust Point, Baltimore, Md.
OFFICE, 225 E. German St., " "

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS. } BANGS & HORTON, 60 Congress St., Boston.



Keller's Adjustable Coke Crusher.

SIMPLE, STRONG, AND DURABLE.

C. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. Columbus, Ind.

Correspondence Solicited.

King's Treatise on Coal Gas.

The most complete work on Coal Gas ever published.

Three Vols. Bound, $30.

BOOKS.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR.

By GEORGE LUNGE. Price $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS.

By DAVID A. GRAHAM. 8vo., Cloth. Price $3.

Orders for these books may be sent to this office.

A. M. CALLENDER & CO.,
42 PINE ST., N. Y. CITY

GAS COALS.

THE PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes.

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS,

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, General Agent, - - No. 1 Broadway (Room 217) New York City.

GAS COALS.

FRANCIS H. JACKSON, Prest. EDMUND H. MCCULLOUGH, V.-Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

The American Gas Engineer and Superintendent's Handbook.

By WILLIAM MOONEY.

Consisting of Rules, Reference Tables, and Original Matter Pertaining to the Manufacture, Manipulation, and Distribution of Illuminating Gas.

350 Pages, Full Gilt Morroco. $3.00.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

JOHN J. GRIFFIN & CO.,

Nos. 1513, 1515, 1517 & 1519 Race Street, PHILADELPHIA.
52 Dey St., NEW YORK. 75 N. Clinton St., (FRED. R. PERSONS, Mangr.) CHICAGO.

MANUFACTURERS OF

METERS FOR MEASURING GAS

IN ANY VOLUME.

Provers, Gauges, Registers, Etc., Etc

EXPERIMENTAL APPARATUS FOR QUANTITATIVE AND QUALITATIVE ANALYSIS.

Careful and Prompt Attention paid to Repairing of all kinds of Meters and Apparatus.

Estimates Cheerfully Furnished.

Dry Gas Meters.

With 40 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges, Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

HAROLD J. BELL. S. LEWIS JONES.

BELL & JONES,

No. 12 North Ninth Street, Philadelphia, Pa. Works at Royersford, Pa.

MANUFACTURERS OF

GAS METERS, STATION AND EXPERIMENTAL METERS,

Meter Provers, Pressure Gauges, and All Other Gas Appliances in Our Line.

WE REPAIR ALL KINDS AND MAKES OF METERS, AND THE WORK GUARANTEED.

High Pressure Meters for Natural Gas, in Iron Cases, guaranteed to stand 300 lbs. Pressure. Gas Cooking and Heating Stoves, Hot Plates, Cake Griddles, Waffle Bakers, Boiling Stoves, Laundry and Tailors' Iron Heaters. Hotel and Cafe Ranges a Specialty.

Correspondence Solicited. **Estimates Furnished.**

A. HARRIS. E. L. HARRIS. J. A. HARRIS.

Established 1849.

HARRIS BROS. & CO.,

Twelfth and Brown Streets, Philadelphia.

Manufacturers of Wet and Dry Gas Meters,

STATION METERS, METER PROVERS,

EXPERIMENTAL METERS, SHOW OR GLAZED METERS,

Pressure and Vacuum Registers, Gauges, Photometers, Drip and Bell Pumps, Etc., Etc.

PROMPT ATTENTION GIVEN TO ALL ORDERS. METERS THOROUGHLY REPAIRED. ESTIMATES FURNISHED FOR STATION METERS OF ALL SIZES. CORRESPONDENCE SOLICITED.

GAS METERS. GAS METERS. GAS METERS.

GEO. J. McGOURKEY, Prest. WM. H. McFADDEN, Vice-Prest. (Phila.) WM. N. MILSTED, Gen. Supt. and Treas. (New York). WM. H. DOWN, Sec.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
177 Elm Street, Cincinnati.
244 & 246 N. Wells Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

GAS METER MANUFACTURERS,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

WET AND DRY GAS METERS. STATION METERS, EXPERIMENTAL METERS, METER PROVERS,

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works.

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of **all makers.**

WM. WALLACE GOODWIN, President and Treasurer. E. STEIN, Vice-President. H. B. GOODWIN, Secretary and Superintendent.

THE GOODWIN GAS STOVE AND METER CO.,

Successors to W. W. GOODWIN & CO.

1012, 1014 and 1016 Filbert St., Phila., Pa. 113 Chambers St., New York City. 76 Dearborn, St., Chicago, Ills.

WALDO BROTHERS, Agents, 88 Water Streets, Boston, Mass.

MANUFACTURERS OF

DRY AND WET GAS METERS,

Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc. Meter Provers (sizes 2, 5, and 10 feet), Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6, and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Center Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete. Also, Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

Manufacturers of the "SUN DIAL" GAS STOVES, for Cooking and Heating.

Goodwin's Improved Lowe's Jet Photometer. **Agents for Bray's Patent Gas Burners and Lanterns.**

Special attention to Repairs of Meters and all Apparatus connected with the business. All work guaranteed first-class in every particular. Orders filled promptly.

G. B. EDWARDS, Manager, New York. S. S. STRATTON, Manager, Chicago.

D. McDONALD & CO.,

GAS METER MANUFACTURERS.

(Established 1854.)

51 Lancaster St., Albany, N. Y. 34 & 36 West Monroe St., Chicago, Ill.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC.

Also STAR GAS STOVES, RANGES, and HEATING STOVES.

We use only the very best materials, and employ the most skilled labor, and by our long experience (36 years) and personal supervision of every detail, we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the State Inspector's Badge, and will be fully warranted by us. Our Annual and Calendar will be sent to Gas Companies upon application.

GAS INTO POWER,

BY THE

OTTO GAS ENGINE.

GAS POWER.—A Source of Revenue to Gas Companies ready to engage in Electric Lighting, building of Water Works, Electric Street Railways, etc.

Coal for producing Gas is less in amount than that for producing Steam, both being measured on an equal amount of work performed. And, further, with Gas,

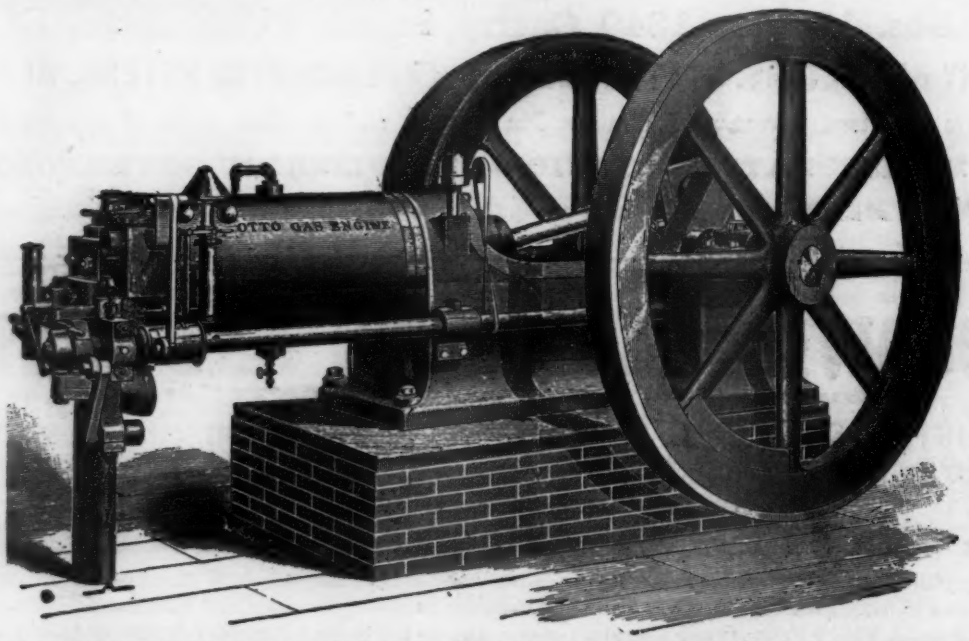
50 to 90 per Cent. of Value of Coal is Returned

by sale of Coke and Tar, according to the market value of these products.

Labor for handling fuel is **reduced,** by its becoming centralized and confined to the gas house, and frequently has not increased after the addition of a power station.

With Gas Power, **cost of fuel** is strictly **limited** to the time of use.

MANY VALUABLE AND RECENT IMPROVEMENTS.



SIZES, 1-3 to 100 HORSE POWER.

Wherever Gas Companies tried Gas Power with Steam Power together in one Station, the use o Steam was subsequently abandoned or restricted, and Gas Power made to take its place.

Where Gas Companies adopt Gas Power for Electric Plants, Water Works, Sewerage, etc., they not only choose **the most economical power for their use,** but secure to themselves the **numerous advantages of increased production,** without increase of expense, and benefit thereby their entire manufacture. They induce consumers, by their example, to abandon Steam for Gas Power, and, by establishing special rates, make

Gas Power the Leading Power of To-Day,

AND SOLVE AT ONCE THE QUESTION OF FUEL GAS.

"Otto Gas Engine Works,"

SCHLEICHER, SCHUMM & CO.,

151 Monroe St. (Kent Building), Chicago. **33d & Walnut Sts., Phila.**

NEW YORK AGENCY, 18 VESEY STREET.